SDMS US EPA Region V

Imagery Insert Form

Document ID: 177477

Some images in this document may be illegible or unavailable in SDMS. Please see reason(s) indicated below:

[X] Illegible due to bad source documents. Image(s) in SDMS is equivalent to hard copy.

Specify Type of Document(s) / Comments:

TITLE PAGE AND SECTION DIVIDER PAGES

[ ] Includes _____ COLOR or _____ RESOLUTION variations.
Unless otherwise noted, these pages are available in monochrome. The source document page(s) is more legible than the images. The original document is available for viewing at the Superfund Records Center.

Specify Type of Document(s) / Comments:

[ ] Confidential Business Information (CBI).
This document contains highly sensitive information. Due to confidentiality, materials with such information are not available in SDMS. You may contact the EPA Superfund Records Manager if you wish to view this document.

Specify Type of Document(s) / Comments:

[ ] Unscannable Material:
Oversized ____ or ___ Format.
Due to certain scanning equipment capability limitations, the document page(s) is not available in SDMS. The original document is available for viewing at the Superfund Records center.

Specify Type of Document(s) / Comments:

[ ] Document is available at the EPA Region 5 Records Center.

Specify Type of Document(s) / Comments:

Rev. 07/10/02

Draft Report

177:71

O'BRIEN & GERE

CERTIFIED MAIL - RETURN RECEIPT

25 August 1989

Director, Waste Management Division
USEPA, Region V
Attn: Mr. Brad Bradley (5HE-12)
230 S. Dearborn Street
Chicago, IL 60604

Director, Illinois Environmental
Protection Agency
Attn: Mr. Ken M. Miller
2200 Churchill Road
Springfield, IL 62706

File: 2844.012

Re: Taracorp Site

At the request of Stephen W. Holt of NL Industries, we are forwarding the attached Draft Preliminary Feasibility Study Report for the Taracorp Site in Granite City, Illinois. This Preliminary Report is submitted in accordance with requirements 13(b)(7) of the Agreement and Administrative Order by Consent between USEPA Region V and NL Industries, Inc.

Very Truly Yours,

O'BRIEN & GERE ENGINEERS, INC.

Frank D. Hale, P.E.
Managing Engineer

FDH:bh
Enclosure

cc: Stephen W. Holt
Janet Smith, Esq.

Deputy Chief, Environmental Control Division
Illinois Attorney General's Office
500 South Second Street
Springfield, Illinois 62706

O'Brien & Gere Engineers, Inc., an O'Brien & Gere Limited Company
440 Viking Drive / Suite 250 / Virginia Beach, VA

2844.012

DRAFT REPORT

FEASIBILITY STUDY
TARACORP SITE
GRANITE CITY, ILLINOIS

AUGUST 1989

PREPARED BY:

O'BRIEN & GERE ENGINEERS, INC.
440 VIKING DRIVE
VIRGINIA BEACH, VIRGINIA 23452

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLES

FIGURES

EXECUTIVE SUMMARY

The Taracorp site located in Granite City Illinois is the location of a former secondary lead smelting facility. Metal refining, fabricating and associated activities have been conducted at the Site since before the turn of the century with secondary lead smelting conducted since 1903. NL Industries entered into an Agreement and Administrative Order by Consent with the USEPA and IEPA in 1985 to implement a Remedial Investigation and Feasibility Study. The Remedial Investigation Report was approved in February 1989. This Draft Feasibility Study summarizes the Remedial Investigation, identifies remedial action objectives, develops remedial alternatives, and presents an evaluation of remedial alternatives.

The substances detected at the site at concentrations above background include several heavy metals and anions such as sulfates. EP Toxic characteristic hazardous wastes are present in the Taracorp Pile and in battery case material piles located on adjacent property owned by Trust 454. The total volume of these materials has been estimated at 85,000 cubic yards (CY) with a mass of approximately 265,000 tons.

Off-site soils demonstrate concentrations of lead which range from expected background in certain residential neighborhoods to 9250 mg/kg on Trust 454 property. EP Toxicity testing on a soil sample with a total lead concentration of 3110 mg/kg demonstrated that the lead in the soil sample was not extractable, therefore, this material is not a hazardous waste under 40 CFR 261.

Two off-site areas where battery case material was reportedly transported were tested and determined to have elevated lead concentrations in the soil. At Eagle Park Acres, the volume of material is approximately 2700 CY. Cover used on selected alleys in Venice Township also contains case material. The volume of alley cover which contains elevated lead concentrations is approximately 670 CY.

Groundwater quality in this industrialized area does not meet IEPA groundwater quality standards. Hydraulically upgradient wells contain elevated concentrations of dissolved solids and selected metals. On-site wells indicate that manufacturing activities on the site over the past century have caused some changes in water quality. Perimeter wells located on the hydraulically downgradient boundary do not demonstrate migration of lead or other heavy metals from the site.

A risk assessment was presented in the Remedial Investigation (RI) Report. The RI Report concluded that human exposure to lead from inadvertent soil ingestion, and to a lesser extent from inhalation of dusts, was possible. The absence of downgradient groundwater usage for potable supplies and lack of heavy metals at the hydraulically downgradient property boundary indicate no human exposure to heavy metals in groundwater emanating from the site.

The quantitative risk assessment evaluated several pathways and exposure scenarios. That risk assessment concluded that direct contact with the contents of the Taracorp Pile or battery case material could under certain exposure conditions create a risk to human health. Under the worst case conditions, some increase in blood lead concentration could be expected in selected residential areas near the site. The impact of that increase on public health is the subject of debate because the projected increase would result in anticipated blood lead levels below current standards. However, current standards are being evaluated by the toxicological community for adequacy.

Applicable or Relevant and Appropriate Requirements (ARARs) were obtained from USEPA and IEPA. The supplied information was used to provide a summary of chemical specific, action specific and location specific ARARs for the site.

Remedial Action Objectives for waste piles, soils, groundwater and air were established based on the ARARs and protection of human health and the environment. Management of materials in the Taracorp Pile and the piles of case material located on Trust 454 property should be in accordance with state and federal hazardous waste regulations. No chemical specific ARARs exist for soils containing lead. Therefore, the site specific risk assessment was used to establish areas where remediation would be considered. Groundwater hydraulically upgradient of the site does not meet Illinois potable water standards. Based on no usage of groundwater for potable supplies hydraulically downgradient of the site, and the absence of heavy metals at the hydraulically downgradient wells on the property boundary, remediation of groundwater at the site is not justified. Remediation of the waste piles and soils must comply with ARARs for lead in ambient air and the work place.

Alternatives considered ranged from implementing institutional controls at the site to excavation and transport of all materials off-site for long term management. The alternatives evaluated varied somewhat in the remediation considered for off-site areas. A screening of alternatives was conducted, as was a detailed evaluation, in accordance with USEPA guidance documents.

Alternatives which include the excavation and processing of the bulk materials in the Taracorp Pile (E, F, and G) will result in the atmospheric release of lead dust, generation of lead contaminated wastewater which will have to be managed, and an insignificant change in mobility and toxicity for the materials which remain after processing. Although these alternatives can also meet the ARARs, these alternatives do not meet the intent of SARA and are not considered acceptable remedial alternatives.

The evaluation of alternatives concluded that Alternative C satisfied the requirements for a remedy as defined in SARA and was the preferred remedy. This alternative involves the excavation of soils from residential and commercial areas around the site, with restoration of these areas. It includes the excavation of remote areas where case material was deposited in the past, with restoration. In addition, this alternative includes the recycle and reuse of contained drosses and dusts present within the Taracorp Pile. Finally all excavated soils and case material would be consolidated in the existing 260,000 ton Taracorp Pile and covered with a multimedia cover. The cover would consist of a two foot thick 10-7 cm/sec clay barrier overlain by a synthetic membrane and necessary drainage layers.

SECTION 1 - INTRODUCTION

1.1 Objectives and Overview

A Remedial Investigation (RI) Report was completed for the Taracorp Site (Site) in Granite City, Illinois. The RI Report was approved by the USEPA and Illinois EPA on February 6, 1989. The following is the Draft Feasibility Study Report, which documents the formulation and evaluation of remedial alternatives for the site.

The Report is divided into four sections, tables, figures, appendices, and exhibits. A brief overview of these sections follows.

Section 1 presents information on the site, its history, and environmental conditions at the site and its environs. This section is intended to summarize the information contained in the approved RI Report. In addition it presents a discussion of contaminant fate and transport as well as a summary of the baseline risk assessment.

Section 2 presents the identification and screening of remedial technologies. Included within this section is the presentation of remedial action objectives as well as a description of technologies which address the remedial action objectives.

Section 3 presents the development of the preliminary remedial alternatives. This section combines technologies applicable to different media into remedial alternatives which address all of the remedial objectives. This section also screens the remedial alternatives for effectiveness, implementability, and cost.

Section 4 presents an evaluation of the alternatives developed in Section 3. Each alternative is evaluated in detail with respect to short term effectiveness, long term effectiveness, reduction of toxicity, mobility, and volume, implementability, cost, compliance with ARARs, and overall protection of human health and the environment. An alternative comparison is also provided.

Tables have been prepared to summarize data generated as part of this study.

Figures prepared to help summarize and present key issues are included in the Report.

Appendices include raw data, calculations, or other materials prepared by O'Brien & Gere which support the interpretations presented in the Report.

Exhibits include tables, reports, or other information prepared by an organization other than O'Brien & Gere which would assist a reviewer in understanding the Report.

1.2 Site Background Information

1.2.1 Site Description

The Site is located within a heavily industrialized section of Granite City, Illinois, a community of approximately 40,000 people across the Mississippi River from St. Louis, Missouri. Although the site is located within the Mississippi River Valley, it is not within the 100 year flood plain of any surface water. The location of the site is shown on Figure 1; Figure 2 presents a zoning map for the area surrounding the Site.

1.2.2 Site History

The Taracorp Site is the location of a former secondary lead smelting facility. Metal refining, fabricating, and associated activities have been conducted at the Site since before the turn of the century. Prior to 1903, the facilities at the Site included a shot tower, machine shop, factory for the manufacture of blackbird targets, sealing wax, manufacture of mixed metals, refining of drosses, and the rolling of sheet lead. From 1903 to 1983 secondary lead smelting occurred on-site. Secondary smelting facilities included a blast furnace, a rotary furnace, several lead melting kettles, a battery breaking operation, a natural gas fired boiler, several baghouses, cyclones and an afterburner. Secondary lead smelting operations were discontinued during 1983 and equipment dismantled.

In June of 1981, St. Louis Lead Recyclers,Inc. (SLLR) began using equipment on adjacent property owned by Trust 454 to separate components of the Taracorp waste pile. The objective was to recycle lead bearing materials to the furnaces at Taracorp and send hard rubber and plastic off site for recycle. SLLR continued operations until June 1983 when it shut down its equipment. Residuals from the operation remain on Trust 454 property as does some equipment.

A State Implementation Plan - Granite City was published in September 1983 by the IEPA. The IEPA's Report indicated that the lead nonattainment problem was in large part attributable to emissions associated with operation of the secondary lead smelter and lead reclamation activities conducted by SLLR. The IEPA procured Administrative Orders by Consent with Taracorp, St Louis Lead Recyclers Inc, Stackorp Inc, Tri-City Truck Plaza, Inc. and Trust 454 during March 1984. The orders specified the implementation of remedial activities relative to the air quality.

Due to Taracorp's Chapter 11 bankruptcy and NL's former ownership of the Site, NL voluntarily entered into an Agreement and Administrative Order by Consent with the USEPA and IEPA in May 1985 to implement a Remedial Investigation and Feasibility Study (RI/FS) of the Site and other potentially affected areas. The USEPA determined that the Site was a CERCLA facility and it was placed on the National Priorities List on June 10, 1986.

1.3 Nature and Extent of Contamination

1.3.1 Contaminants Detected

The RI Report presented considerable information on site conditions and substances present. This subsection is intended to summarize that document to establish basic information necessary to evaluate remedial options.

In selected locations substances detected at concentrations above background during the RI fit into two basic categories: heavy metals and anions. With the exception of the ground water analyses, lead was consistently at higher concentrations than other metals. Lead in the ground water was either not detectable or at concentrations below the MCL; however, cadmium and arsenic were detected at concentrations above the MCL in the shallow ground water. The anions identified in the ground water were primarily sulfates and carbonates.

1.3.2 Taracorp Pile

Located on the site is a pile composed primarily of blast furnace slag and battery case material. Figure 3 is a topographic survey of the Taracorp Pile. The volume of the pile is approximately 85,000 cubic yards. In addition, smaller piles immediately adjacent to the Taracorp pile, which were associated with the adjacent SLLR recycling operation, comprise approximately 2450 cubic yards. Tests conducted on the materials in the Taracorp piles demonstrate lead concentrations in the range of 1-28%. EP toxicity test results demonstrate that the waste pile materials are a characteristic hazardous waste under 40 CFR 261. In addition, on the surface of the pile are 25-35 containers holding solid wastes from the smelting operations which normally are recycled. These containers remained after the smelting operations ceased in 1983.

1.3.3 Area 1 Battery Case Material and Soils

Area 1 consists of property owned by Trust 454 and Tri City Trucking. These properties abut the Taracorp Site and were the subject of previous regulatory action. The limits of Area 1 are shown on Figure 4.

Trust 454 property contains a pile of battery case material as well as unpaved areas. The SLLR pile contains approximately 3920 cubic yards in two general areas. The lead concentration range in this pile was 10-30%. EP toxicity analyses of the pile materials indicate that this material has characteristics similar to those of the Taracorp pile and should be managed as hazardous waste. Analyses of the unpaved area indicate a lead concentration at the surface of 9250 mg/kg. All lead concentrations in solid matrices are reported on a dry weight basis. The paving of the unpaved area was the subject of a Consent Order signed by SLLR, Trust 454, and Stackorp during 1984. This paving has not been implemented as of August 1989.

Tri City Trucking property includes a large unpaved area which is used to park and service trucks. Analyses of soils from areas around this property suggest that the soils contain lead concentrations on the order of 4000 mg/kg. A Consent Order signed by Tri City Trucking in 1984 required the paving of this unpaved area.

1.3.4 Surface Soils

Surface soil samples were collected from 50 locations not including Taracorp or Trust 454 properties. Figure 4 presents the soil sample locations and the results of surface soil analyses. Generally samples were collected at depths of 0-3 and 3-6 inches below grade. With the exception of one anomalous value, approximately 3200 feet from the site boundary, the results indicate that the lead concentration in surface soils (0-3 inches) within 1/4 mile of the site boundary were higher (514-4150 mg/kg) than those further from the site (200-500 mg/kg). Samples collected from the surface (0-3 inches) generally contained more lead (average 1160 mg/kg) than the deeper (3-6 inch) samples which averaged 560 mg/kg.

EP Toxicity testing of a soil sample with a total lead concentration of 3110 mg/kg demonstrated that the lead in the soil sample tested was not extractable, therefore, soils with equivalent or lesser lead concentrations are not a characteristic hazardous waste under 40 CFR 261.

1.3.5 Eagle Park Acres

Eagle Park Acres includes some vacant land to which battery case material was previously hauled. Figure 5 presents the soil sample locations and analytical results. The battery case material was used to fill a ditch on the property and a portion has been uncovered during subsequent excavation. The approximate volume of material and surrounding soil at Eagle Park Acres is 2700 cubic yards. Testing of the soil in this area indicated surface lead concentrations ranging from 63 mg/kg to 3280 mg/kg.

1.3.6 Venice Township Alleys

According to residents in the area, Venice Township hauled hard rubber case material to unpaved alleys in Venice Township. Figure 6 presents the sample locations and soil lead results for this area. Tests conducted on these alleys resulted in a wide range of lead concentrations. Surface lead concentrations ranged from 200 mg/kg to 126,000 mg/kg. The estimated volume of battery case material and associated soil in these alleys is 670 cubic yards.

1.3.7 Ground Water

The Site is underlain to a depth of approximately 100 feet by alluvial, glaciofluvial, and glaciolacustrine deposits. These deposits become progressively coarser with depth. Recharge to ground water within the area is from precipitation and infiltration from surface water. The area receives approximately 35 inches of precipitation annually with an average pH of wet deposition of approximately 4.4 Standard Units (S.U.). Water within the unconsolidated deposits beneath Granite City is used for industrial and flood control purposes. No potable uses for the ground water between the site and the Chain of Rocks Canal were identified after a thorough review of Illinois State Water Survey records. The area surrounding the site has city water obtained from the Mississippi River.

Twelve monitoring wells were installed as part of a ground water investigation which began in October 1982. Figure 7 illustrates the location of these wells relative to the site. The ground water flows in a south-south westerly direction towards the Mississippi River at a velocity ranging from 0.002 feet/day to 0.5 feet/day.

Ground water quality since 1982 has remained reasonably consistent. Lead concentrations observed in all wells have generally remained less than 0.02 mg/l, within the drinking water standards for lead of 0.05 mg/l. Background ground water quality in the shallow wells is characterized by dissolved solids ranging from 625 mg/l to 1000 mg/l, sulfates ranging from 165 mg/l to 320 mg/l, and a pH of 6.6. Background ground water quality in the deeper wells is characterized by dissolved solids of 993 mg/l, alkalinity of 430 mg/l as CaCO3, sulfate of 288 mg/l, and a pH of 6.7 S.U. In addition, the filterable manganese concentration was 0.99 mg/l. Accordingly, the ground water is not suitable for development as a potable supply due to concentrations of dissolved solids, sulfates, and manganese above values presented in 40 CFR 143 (dissolved solids (500 mg/l), sulfate (250 mg/l), manganese (0.05 mg/l)).

Tables 1 and 2 present the results of ground water quality analyses conducted as part of the Remedial Investigation. A shallow and adjacent deep well located on the site demonstrated elevated concentrations (as compared to background) of sulfates, dissolved solids, arsenic, cadmium, manganese, nickel, and zinc. However, data from shallow wells located at the hydraulically down gradient property boundary demonstrated water quality similar to that in the background monitoring well. This suggests that heavy metals are not migrating off the site in this zone. This is explained by the high alkalinity of the ground water, the low solubility of metal carbonates, and cation exchange within the unconsolidated deposits.

Hydraulically downgradient wells screened in the deeper zone demonstrate water quality similar to that of the background well. With the exception of iron and manganese, elevated metal concentrations were not observed. However, deep well spacing on the hydraulically downgradient boundary of the property is not optimum, and one additional deep well is incorporated in each remedial alternative to be considered. Although comprehensive data on deep groundwater quality is not available, no users of this water for drinking water were identified after a review of state records.

As background groundwater quality precludes the use of site groundwater as a potable source, as significant contamination has not been identified downgradient, and as no downgradient users of groundwater for drinking purposes have been identified, present data does not support groundwater remediation.

1.4 Contaminant Fate and Transport

1.4.1 Air Pathway

A variety of activities have contributed to the lead residues monitored in the Granite City study area. Combustion of coal, fuel oil, and leaded gasoline all contribute lead to the urban environment. In addition, the various lead smelting activities carried out on the Taracorp site have contributed lead to the study area. These combined sources resulted in ambient air concetrations in excess of the Ambient Air Quality Standard of 1.5 ug/m3 prior to 1983, when the blast furnace was shut down. Table 3 presents air quality data for the period 1978 through 1986. More recent data is similar to that obtained for 1986.

In addition to the above referenced sources of lead, two site related sources remain in the study area which provide for a potentially functional air exposure pathway: the exposed lead bearing wastes at the Taracorp facility and exposed soils of surrounding areas which received fallout in the form of particulate lead from emissions of lead smelting operations. These particulate lead residues may become airborne as the result of wind, traffic and movement of heavy machinery, and recreational activities in exposed soil areas.

Off-site airborne transport of lead residues from the Taracorp facility in the form of windborne particles, with subsequent off-site direct contact exposure to deposited particles, is currently minimal since the facility ceased smelting operations. This conclusion is supported by air monitoring in the study area, which during 1987 averaged 0.26 ug/m^3 of lead, 17% of the national ambient air standard for lead.

1.4.2 <u>Soil and Direct Contact Pathway</u>

Operation of the smelting facility for over eighty years has resulted in elevated surface and subsurface soil residues which represent a functional pathway for exposure via direct contact and subsequent ingestion of lead-contaminated soils. Another mechanism which occurred is the transport of case material to off site areas.

1.4.3 <u>Surface Water Pathway</u>

The surface water pathway was determined to be non-functional based on the absence of surface waters in the study area. Observed runoff away from the area of the Taracorp pile is limited to the property of Tri City Trucking, Trust 454, and Taracorp.

1.4.4 <u>Ground Water Pathway</u>

Transport of contaminants by ground water was determined to be incomplete based on the absence of ground water wells known to be used as drinking water sources. In addition, discharge of site-related ground water to surface water other than to the Chain of Rocks Canal is not probable.

1.4.5 Summary

The results of the evaluation of site related contaminant transport and fate in the study area indicate two scenarios for potential human exposure to lead in addition to conventional urban lead sources. These pathways are 1) the airborne route, with lead bearing soil particulates and dusts transported from friable soils on the Taracorp site and adjacent soils/piles in Area 1 to off-site locations for subsequent inhalation; 2) the direct contact route, with exposed soils previously contaminated with lead from particulate fallout providing a source for ingestion of lead residues.

1.5 Baseline Risk Assessment

The RI presented a detailed site specific risk assessment which addressed on site and off site conditions and exposures. The RI Report determined that because of soil lead concentrations, human exposures via inadvertent soil ingestion and, to a lesser extent, by inhalation of dusts was possible.

The quantitative risk assessment of the complete exposure scenarios at the Granite City study area was conducted using a three pronged approach. First, available monitoring data for blood lead content of area residents was compared with values considered by health agencies to constitute a level of concern. Secondly, a hypothetical worst case scenario was analyzed, which assumed chronic lifetime contact with exposed soils. Finally, an available published study was utilized which provided a basis for estimating incremental increases in blood lead due to exposure to increasing levels of soil lead. The results of all three approaches indicate that the soil lead and air residues present in the Granite City study area do not represent an unacceptable risk to public health. Higher exposed surface lead residues exist in areas of Venice Township which, under chronic exposure conditions, could impact human health. However, a survey of blood lead content in residents of this area did not produce evidence of such a health impact, suggesting that significant exposure to these residents is not occurring.

The approval of the RI Report by the U.S.EPA included necessary changes to the RI Report. Since the U.S. EPA withdrew the reference dose for lead prior to submission of the RI Report, they were unable to endorse the risk assessment presented in the RI Report. In the RI Report approval letter, the U.S.EPA uses a recommendation derived from a 1977 air quality criteria document for lead which states "In general, lead in soil and dust appears to be responsible for blood lead levels in children increasing above background levels when the concentration in soil or dust exceeds 500-1000 ppm". This recommendation was adopted by the Center For Disease Control (CDC) in their 1985 document Preventing Lead Poisoning in Young Children, (Center for Disease Control, 1985).

In summary, the impact of lead on public health is under considerable investigation at this time. The U.S.EPA is considering establishing a task force to evaluate risks associated with exposure to lead in surface soils. The results of the site specific risk assessment and consideration of U.S.EPA's comments on that risk assessment, suggest that under worst case conditions some increase in blood lead concentration could be expected in selected areas around the site. The impact of that increase is the subject of considerable debate within the community of toxilogical experts.

1.6 Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements (ARARs) establish a framework for the selection of a remedial alternative at the Taracorp site. Draft Guidance on the selection and use of ARARs is provided in an August 1988 publication titled CERCLA Compliance with Other Laws Manual (USEPA, 1988). ARARs are site specific, therefore, the purpose of this section is to identify ARARs and other information to be considered (TBCs) during the evaluation of remedial alternatives at the Taracorp Site.

ARARs are conveniently separated into three general types: chemical specific, action specific, and location specific.

Chemical specific requirements ".. are usually health or risk based numerical values or methodologies which, when applied to site specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to the ambient environment." (USEPA, 1988)

Action specific requirements ".. are usually technology or activity based requirements or limitations on actions taken with respect to hazardous wastes". (USEPA, 1988)

Location specific requirements "..are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations" (USEPA,1988).

This section is organized to address these general categories of ARARs. In accordance with a February 1 letter from USEPA to NL Industries addressing potential ARARs, the State of Illinois is authorized to operate their hazardous waste management program in lieu of the Federal program with the exception of HSWA requirements. The State regulations are cited with Federal regulations cited only when State regulations are not available, or when the Federal ARAR is more stringent.

1.6.1 Chemical Specific Requirements

Chemical specific requirements are presented for each medium of interest at this site.

Air

Table 4 presents air related ARARs. The applicable numerical criteria for lead in ambient air is defined as 1.5 ug/m^3. In addition, construction activities must meet regulations for worker exposure to lead in air incorporated in 29 CFR 1910.1025.

Taracorp Pile and Other Wastes

Chemical specific ARARs for solid wastes independent of selected actions at the site have not been identified.

Soils

Chemical specific ARARs for soils independent of selected actions at the site have not been identified.

Surface Water

The absence of surface water near the site and demonstrated ground water quality indicates that there are no surface water related ARARs. Should a remedial technology result in the collection of runoff from the pile or leachate for discharge to the Granite City sewer system then existing sewer use ordinances would be considered as Action Specific ARARs.

Ground Water

Under the Ground Water Protection Strategy EPA has defined three aquifer classes:

Class 1, Special Ground Water which includes those aquifers highly vulnerable to contamination and either irreplaceable sources of drinking water or ecologically vital.

Class 2, Current and Potential Sources of Drinking Water Having Other Beneficial Uses, includes all other ground water currently used or potentially available for drinking water or other beneficial uses.

Class 3, Ground Water Not Considered a Potential Source of Drinking Water and of Limited Beneficial Use, includes saline or otherwise contaminated ground water beyond the level of cleanup currently employed in public water system treatment. The ground water must not migrate to Classes 1 or 2 ground waters or discharge to surface water and cause further degradation.

Based on information provided by the Illinois State Water Survey, ground water is not currently being used as a drinking water source in Granite City. As presented in Section 1.3.7, municipal water derived from the Mississippi River is provided to the area hydraulically down gradient of the Taracorp Site. Existing wells in the area have been identified as supplying water for flood control and lawn care; not potable uses.

Hydraulically upgradient wells contain total dissolved solids, manganese and sulfates at concentrations above Public and Food Processing Water Supply Standards contained in the State of Illinois Pollution Control Rules and Regulations (PCBRR) Title 35: Subtitle C, Chapter 1,Part 302, Subpart C. These standards are presented in Table 5. Technology for the removal of dissolved solids and sulfates is not currently employed in the Granite City public water system treatment, therefore, the aquifer beneath the site would be identified as a Class 3. Illinois PCBRR provides a water quality standard for waters of the state for which there is no specific designation under Subtitle C, Chapter 1, Part 302,Subpart B. These general use standards are considered applicable for ground water beneath the site and are presented on Table 5.

1.6.2 Action Specific ARARs

Landfill On Site

Testing conducted as part of the RI indicated that materials within the pile are classified as characteristic hazardous wastes because of the extractable metal content. The Illinois regulations concerning management of hazardous waste are contained in Title 35, Subtitle G Part 724. Subpart L addresses the management and closure of Waste Piles. One option for closure under 35 IAC 724.358 is to close the facility with waste left in place. Final cover requirements which are considered relevant and appropriate follow: (35 IAC 724.410 (a))

1. Provide long-term minimization of migration of liquids through the closed landfill;
2. Function with minimum maintenance;
3. Promote drainage and minimize erosion or abrasion of the cover;
4. Accommodate settling and subsidence so that the cover's integrity is maintained; and
5. Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

After closure, the following relevant and appropriate requirements are imposed under 35 IAC 724.410(b):

1. Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion or other events;
2. Continue to operate the leachate collection and removal system until leachate is no longer detected;

3. Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of Subpart F;

4. Prevent run-on and run-off from eroding or otherwise damaging the final cover; and

5. Protect and maintain surveyed benchmarks used in complying with Section 724.409.

Landfill Off Site

Transport of materials from the Taracorp Piles or SLLR Piles would involve compliance with hazardous waste management regulations. 35 IAC Subtitle G, Subpart C, Generators, would be considered the applicable regulation. Transport of off-site soils removed as part of the excavation process are not characteristic or listed wastes, therefore, the applicable regulation would be under 35 IAC 807. Other ARARs which may apply depending on excavation method are listed in Table 4.

Taracorp Pile Treatment On Site

Treatment of the pile contents on-site would involve compliance with technical criteria included in 35 IAC Subtitle G. Such treatment would involve waste segregation and off-site transport. Activities would have to be conducted in a manner which allows meeting chemical specific ARARs included in Table 4.

Taracorp Pile Treatment Off Site

Treatment of pile contents off-site could require transport of all or portions of the pile off-site. The applicable regulation would include generator requirements under 35 IAC Subtitle G, Part 700, Subpart C.

In addition to the action specific ARARs listed above, the fugitive dust regulations of the Clean Air Act, and OSHA regulations (29 CFR 1910), would apply to all remedial activities.

1.6.3 Location Specific ARARs

Flood Plain Regulations

Although the Taracorp Site is not in the Mississippi River Flood Plain surrounding areas are. Because no structures are planned for the surrounding areas, flood plain regulations are not considered ARARs.

Wet Land Regulations

The Taracorp Site and the other areas considered for remediation are not adjacent to surface waters and not included as wetlands. Therefore, wet land regulations are not considered ARARs.

1.7 Remedial Action Objectives

The Remedial Action Objectives for the Granite City site are presented in Table 6 for each complete exposure pathway potentially posing a risk to public health and the environment. The following text presents the logic used to develop those objectives.

Soil

A surface soil lead concentration was identified in the Risk Assessment as being protective of human health within residential areas. For these areas a surface soil concentration protective of human health under upperbound worst case assumptions was calculated at a concentration below 1500 mg/kg of lead in soil. As discussed in Section 1.5 CDC reported that a soil lead concentration in residential areas in excess of the range of 500 to 1000 mg/kg appears to increase blood lead concentrations above background. Based on these considerations the remedial response areas presented in Figure 4 were identified and presented to EPA and IEPA at a meeting held on February 8, 1989. These areas were presented in the Development of Alternatives section dated April 18, 1989, and commented on in a letter dated June 23, 1989.

Present usage of commercial zoned areas is inconsistent with worst case assumptions included in the Risk Assessment. However, portions of these areas could be regularly frequented; therefore, the same criteria will be applied to soils in these areas. Heavy industrial zoned areas are not subject to the same usage; therefore, the remedial action objective for these areas is to be protective of human health under reasonable exposure conditions or a concentration of less than 4800 mg/kg.

The areas around the site have been separated to simplify the discussion of remedial alternatives for soils. Figure 4 presents the three areas being considered during the development of alternatives. The areas include the Taracorp Site and an eighteen block area located to the east and south of the site. These areas were selected based on land use (see Figure 2), measured soil lead concentrations in the vicinity, anticipated transport patterns from the lead smelting operations, and clearly defined boundaries.

As illustrated in Figure 4 and presented in the RI Report there are selected properties within the City which had elevated lead concentrations but have not been included in the areas considered for remediation. These sample locations often included areas near roadways and driveways, and were thus subject to contamination from leaded gasoline. In addition, these areas were not considered to be representative of the worst case risk assessment presented in the RI Report because the contamination is localized and not in areas where gardens or youth activities are anticipated.

Waste Piles

The waste piles consist of various process wastes resulting from secondary lead smelting operations including slag, dross, matte, grid metal, and plastic and rubber battery cases. The risk assessment based response objectives for the surface concentration of the waste pile located in a limited access area is the same as for heavy industrial zoned properties.

Remedial action objectives to be considered in the development of remedial alternatives for the waste piles are presented in Table 6. The major components within the waste pile are blast furnace slag/matte and battery case material which have been determined to have hazardous characteristics pursuant to 40 CFR 261. Consequently, remedial action objectives for this material are those associated with the management of hazardous wastes.

Ground Water

The remedial action objectives for ground water is based on Illinois ground water standards; however, these objectives may be modified to reflect ground water quality entering the site. Table 5 presents the applicable standards for water at the property boundary (i.e. Illinois General Use Standards). The "background" water quality did demonstrate total dissolved solids, manganese, and sulfates at concentrations greater than the Illinois ground water quality standards. The remedial action objective is to limit migration of site related substances to ground water to rates sufficient to allow ground water quality at the property boundary to meet Illinois General Use Standards or match "background" quality if it exceeds the published General Use Standards.

Air

The remedial action objective is to maintain air quality at less than 1.5 ug of Pb/m^3 in ambient air as has been the case at air monitoring stations for the past six years.

SECTION 2 - IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

2.1 Screening Criteria and Methodology

The identification and screening of remedial technologies was accomplished using a multi-phased approach based on that presented in the U.S. EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Interim Final, August 1988) (USEAP 1988 b). The approach used was consistent with the Consent Order and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 CFR Part 300). This section describes and documents the identification and screening of technologies used for the Taracorp site.

Once the remedial action objectives and ARARs are identified (Sections 1.6 and 1.7) general response actions for each medium of interest are defined such that the remedial action objectives would be satisfied. The volumes or areas of contaminated media are then identified, based on the site conditions defined by the RI, and the level of protectiveness specified and screened on the basis of technical implementability. Technology types and process options which cannot be effectively implemented would not be considered further. The remaining process options are then screened in greater detail with respect to the data gathered during the RI based on the following criteria:

1. Effectiveness. This criterion evaluates the technology process options in terms of handling the estimated areas or volumes of contaminated media and meeting the pertinent remedial action objectives. It also considers the effectiveness in protecting human health and the environment during construction and implementation. The criterion also considers how proven and reliable the process option would be relative to site conditions.

2. Implementability. The feasibility of implementing a process option under such institutional constraints as the availability of treatment, storage, and disposal services, special permitting requirements, and the need and availability of equipment and skilled workers is evaluated by this criterion.

3. Cost. A cost analysis limited to relative capital and operation and maintenance costs is conducted.

2.2 Identification of General Response Actions

The remedial action objectives for the Taracorp site are presented in Section 1.7 and Table 6. General response actions pertinent to the Taracorp site will be based on these objectives. The list of general response actions presented in Table 8 and other typical means for addressing the objectives were evaluated relative to the actions. The general response actions which were determined to be applicable to the objectives were institutional actions, containment actions, removal actions, and treatment actions. In addition, no action was also considered in accordance with the USEPA guidance document (USEPA, 1988).

2.2.1 No Action

This general response action does not contain technologies but rather can be used to identify contamination problems in the absence of remediation. No Action is typically carried through the FS as an alternative which is used as a basis for comparing the other alternatives.

2.2.2 Institutional Actions

Institutional Actions include legal, local or state restrictions which can be enacted and enforced to protect public health and the environment in the vicinity of the site before, during, and/or after implementation of the remedial action. Site access restrictions, such as fencing, are also considered institutional controls.

2.2.3 Containment Actions

Containment Actions include technologies which isolate materials from migration pathways or receptors such that exposure pathways are not complete.

2.2.4 Removal Actions

Removal Actions include technologies which prevent complete exposure scenarios by removing the contaminant source. These actions include methods which address soils with unacceptable lead concentrations and the waste piles.

2.2.5 Treatment Actions

Treatment Actions address contaminants by reducing their toxicity, mobility or volume such that acceptable risks are attained.

2.3 Identification and Screening of Technologies

2.3.1 No Action

Description

No Action as a General Response Action does not include any remedial technologies. As will be presented in Section 3, the No Action Alternative considered in this FS includes institutional controls such as fencing, land use restrictions, deed restrictions, and ground water monitoring. The No Action Alternative would thus limit exposure to contaminants and provide continuing information on environmental conditions. It would not, however, achieve all remedial action objectives.

Screening

The initial screening of the No Action General Response Action for contaminated soils/alleys and the waste piles are presented in Tables 9-12. Although no action does not achieve the remedial action objectives, it will be considered further in accordance with the NCP.

2.3.2 Institutional Actions

Descriptions

Institutional Actions include action restrictions for the contaminated soil and fill areas and access restrictions and monitoring for the waste piles. The technologies and process options for this General Response Action are presented in Tables 9 and 10 for the contaminated soil/alley areas and waste piles respectively. As noted in Tables 9 and 10, process options of fencing, land use restrictions, and deed restrictions were identified for the soil/alley areas and waste piles. Ground water monitoring was also identified for the waste piles.

Fencing would include the placement of a fence around the contaminated areas to limit access and thereby reduce risks of direct contact with the contaminated areas. Land use restrictions and deed restrictions would also reduce risks of direct contact with the contaminants by restricting land use. Ground water monitoring would provide information relative to the migration of contaminants off-site.

Screening

The initial screening of technologies and process options for Institutional Actions is presented in Tables 9 and 10. The process options which were identified were found to be potentially applicable. Following the initial screening, the process options were evaluated using the criteria of effectiveness, implementability, and cost. The process option evaluation is presented in Tables 11 and 12 for the soil/alley and waste piles, respectively. Although the process options would not be effective in reducing contamination, the access restrictions would serve to limit access and direct contact exposure, and ground water monitoring would provide information relative to contaminant migration. The identified process options will be considered further.

2.3.3 Containment Actions

Description

Containment Actions include capping and land disposal technologies. The remedial technologies and process options for this General Response Action are presented in Tables 8 and 9 for the contaminated soil/alley areas and waste piles, respectively. The capping process options include clay, asphalt, and concrete for both the contaminated soil/alley areas and waste piles. A multimedia cap is considered for the waste piles as is a supplemental bottom liner. A landfill process option is also considered for both areas.

Capping with clay would involve the installation of compacted clay with a vegetated soil layer over the contaminated areas. Similarly, the use of asphalt, sod, or concrete would involve the installation of a layer of the material over the areas of contamination. A multimedia cap would be comprised of soil bedding, a synthetic membrane, lateral drainage materials, and vegetated soil. These materials would be placed over the areas of contamination. A supplemental bottom liner could be used in conjunction with the multimedia cap. The bottom liner would consist of an impermeable clay layer, a secondary drainage layer, a synthetic membrane, and a primary drainage layer. Utilization of such a bottom liner would require excavation of pile materials and placement of these materials over the bottom liner. Landfilling would include the placement of contaminated soil and other non-hazardous materials in a non-RCRA landfill; hazardous materials would be placed in a RCRA landfill.

Screening

The initial screening of technologies and process options for Containment Actions is presented in Tables 9 and 10. All identified process options, with the exception of capping with sod over the waste piles, were determined to be potentially applicable.

The evaluation of process options using the criteria of effectiveness, implementability, and cost is summarized in Tables 11 and 12 for the contaminated soil/alleys and waste piles, respectively. Relative to the contaminated soil/alleys, two types of areas would need to be addressed: vegetated soil areas (e.g., lawns) and unpaved alleys and driveways. For the vegetated soil areas, sod is the process option selected to represent the capping technologies, whereas asphalt is representative of the capping technologies for the unpaved driveways and alleys. These process options will be considered further. Landfilling will also be considered further. The multimedia cap will be carried forward as representative of capping technologies for the waste piles. The supplemental bottom liner will also be retained for further consideration. In addition, landfilling of waste pile materials will be considered further.

2.3.4 Removal Actions

Description

Removal Actions include the excavation remedial technology which can be utilized to remove materials from their existing locations so they can be managed more appropriately. Excavation process options are presented in Tables 9 and 10 for the contaminated soil/alleys and waste piles, respectively. The identified excavation process options include backhoes, cranes, front-end loaders, scrappers, pumps, industrial vacuum, drum grapplers, and forklifts. The initial screening of technologies and process options is summarized in Table 9 for the contaminated soil/alleys and Table 10 for the waste piles.

Backhoes and front-end loaders were determined to be potentially applicable for excavating the contaminated soil/alley areas. Backhoes, cranes, front-end loaders, and drum grapplers were identified as potentially applicable for excavating the materials found in the waste piles.

The evaluation of process options using the criteria of effectiveness, implementability, and cost is presented in Tables 11 and 12 for the contaminated soil/alley areas and waste piles, respectively. Each of the process options which passed the initial screening also passed the evaluation of process options and will be considered further.

2.3.5 Treatment Actions

Description

Treatment Actions include solidification/stabilization/ fixation, recycle/recovery, thermal treatment, and chemical/ physical treatment technologies. These types of technologies are used to reduce or minimize the mobility, toxicity, or volume of contaminants. As shown in Table 9, solidification/stabilization/ fixation, chemical/physical treatment, recycle/recovery and thermal treatment technologies were identified for the contaminated soil/alley areas. The process options for solidification/ stabilization/fixation include proprietary processes such as those marketed by Chemfix, Lopat Enterprises, and Envirosafe. Soil washing/leaching and in-place precipitation immobilization are process options in the chemical/physical treatment technology. Thermal treatment process options for the contaminated soil/alley include incineration and in-situ vitrification. Hard rubber which was used as fill and paving materials could be recycled/recovered as an additive in the manufacture of asphalt.

The remedial technologies and process options identified for the waste piles are presented in Table 10. The remedial technologies include recycle/recovery, solidification/stabilization/fixation, and thermal treatment. The recycle/recovery process options include segregation methods such as those developed by M.A. Industries, Polycycle, Inc. and Cal West, as well as heavy media separation. Electrowinning, extraction, and asphalt addition are other recycle/recovery process options which could be used to recycle or recover the waste pile materials. The solidification/stabilization/fixation process options which were identified for the contaminated soil/alley areas could also be applied to the waste piles. The thermal treatment process options for the waste piles include in-situ vitrification and secondary lead smelters such as Master Metals.

Solidification/stabilization/fixation processes are used to physically or chemically bind contaminants such that their mobility is reduced or prevented. The processes are most effective when the contaminated materials and stabilizing agents are mixed in a reactor rather than in-situ. Proprietary processes such as those marketed by Chemfix, Lopat Enterprises, and Envirosafe are representative of those available. The stabilization process would render waste materials non-EP Toxic such that they would be managed as non-hazardous waste. This process option could be used to treat contaminated materials from both the soil/alley areas and the waste piles.

The two process options identified for the chemical/physical treatment of contaminated materials were soil washing/leaching and in-situ precipitation immobilization. The soil washing/leaching process option involves the washing of contaminants from the soil using an aqueous solution of acid, base, chelating agent, oxidizing agent, or surfactant. The process would be conducted in a reaction vessel or vessels. The washed soil could be replaced as backfill or landfilled as appropriate. The leachate would be treated. In-situ precipitation immobilization would involve treatment of the soil with a solution which would immobilize the metallic contaminants in the soil column through precipitation. This process would be conducted in-situ.

Several recycle/recovery options were identified, primarily for the waste pile constituents. Separation methods for the waste pile include proprietary processes marketed by M.A. Industries, Polycycle Industries, Cal West, and heavy media separation. M.A. Industries' two systems are for battery reclamation and classification. These separate battery materials (hard rubber, plastics, oxides) using a hydro-classification system. The Polycycle Industries and Cal West systems also use hydro-classification to separate materials and are fundamentally similar to the M.A. Industries system. Heavy media separation processes separate solids of different specific gravity, utilizing a fine-grained solid of high specific gravity suspended in a liquid. Upon introduction into the suspension liquid, solids with a sufficiently high specific gravity sink, whereas solids with low specific gravity float.

Electrowinning is a method by which metals are electrolytically extracted from their soluble salts. In this process, contaminated materials are initially leached, followed by a liquid/solid separation, and then the metals are electrowon in an electrolytic cell.

The hard rubber from the alleys and waste piles could potentially also be used as an additive in the manufacture of asphalt. This would be similar to solidifying the hard rubber materials in that it would result in reduced mobility of contaminant associated with the hard rubber.

Three thermal treatment process options were also identified and screened. These processes included in-situ vitrification, secondary lead smelting, and incineration. In-situ vitrification is a process where an electric current is passed through soil or waste materials between electrodes. The resistance to the electric current generates enough heat to oxidize organic constituents and melt soil. The metallic constituents are sealed in the resulting glass-like matrix. Off-gases are collected and treated.

A secondary lead smelter could be used to recover lead remaining in some of the waste pile constituents. A minimum lead content of 27% is often considered a minimum cutoff for secondary smelter feed. This would have to be preceded by a separation technology such that the lead-bearing materials could be separated from the non-smeltable materials. Master Metals, Inc. of Cleveland, Ohio, currently operates a secondary lead smelter.

Incineration is a process whereby organic constituents are oxidized or pyrolyzed. In some cases, inorganic constituents have reportedly been fixed in the ash such that non-EP toxic conditions are established. In other cases, this has not been the case.

Screening

Tables 9 and 10 summarize the initial screening of Treatment Action technologies and process options for the soil/alley areas and waste piles, respectively. For the soil/alley areas, solidification/stabilization/fixation, using a proprietary process, and chemical/physical treatment using soil washing/leaching were determined to be potentially applicable for either the soil or alley fill and paving materials. Using the alley fill and paving material (hard rubber) as an asphalt addition was also determined to be potentially applicable. Relative to the waste piles, segregation using M.A. Industries/Polycycle Industries/Cal West, secondary smelting, and using the hard rubber as an asphalt additive were determined to be potentially applicable.

These potentially applicable options were then evaluated using the criteria of effectiveness, implementability and cost. The results are summarized in Tables 11 and 12 for the contaminated soil/alley areas and waste piles, respectively. The process options of segregation (M.A. Industries, Polycycle Industries, or Cal West) and secondary lead smelting will be considered further.

2.4 Summary of Remedial Technology Screening

The remedial technologies and process options which passed the screening process are presented in Tables 11 and 12. These technologies and process options will be used to develop remedial alternatives, as presented in Section 3.

SECTION 3 DEVELOPMENT OF REMEDIAL ALTERNATIVES

3.1 Development of Remedial Alternatives

The screening of the remedial technologies summarized in Section 2 eliminated those which were not protective of the public health or the environment or were not technically or economically feasible. This process resulted in the selection of several representative process options as identified in Tables 11 and 12. In this section the selected process options will be combined into a series of remedial alternatives which address each of the media targeted for remediation.

The Remedial Alternatives are illustrated on Table 13. Common to many of the remedial alternatives are institutional controls. The institutional controls available considered in this alternative are summarized below.

Site Access Restrictions - A fence is an effective method for preventing unintentional contact with contaminated soils and discouraging intentional contact.

Restrictive Covenants - Restrictive covenants can be imposed on the use of the property. A property owner may proscribe property use above and below the ground surface. Restrictions against use of the surface part of the property could include prohibitions against any construction which would disturb a surface cap. Restrictions against subsurface use could include prohibitions against excavations into subsurface contamination or installation of borings for any purpose, including ground water withdrawal wells. Institutional controls on property not owned by Taracorp could be implemented either through private agreements or through the EPA's authority to exercise eminent domain.

Covenant Not to Sell Property - Taracorp has the right to covenant not to sell the property. Execution of an instrument is legally binding on Taracorp as well as on its successors and assigns.

Conveyance of Rights to a Third Party - Taracorp could convey portions of the property to another party such as the State of Illinois. Such a conveyance would ensure that institutional controls be maintained in perpetuity.

3.1.1 Alternative A

Monitoring: Air Quality Monitoring; Ground Water Monitoring

Institutional Controls: Site Access Restrictions; Land Use Restrictions; Deed Restrictions; Sale Restrictions

The no action alternative (A) includes a group of activities that can be used to monitor contaminant transport. The sources considered potentially viable include air, surface soils, and ground water. These activities are designed to prevent unacceptable risks to the public posed by the contaminants present in the Taracorp and SLLR piles. It includes institutional controls on the Tarcorp property and other properties where residual concentrations do not meet Remedial Objectives.

Ground water monitoring would be performed twice per year at each of the existing wells illustrated on Figure 7. Moreover, an additional well would be installed adjacent to well 104. This new well, screened at a lower elevation than well 104, would be used to better define ground water quality in the deeper water table aquifer. The analytical program would include pH, conductivity, alkalinity, sulfate, total dissolved solids, arsenic, cadmium, and lead.

High volume air monitors are presently located in Granite City as illustrated in Figure 8. A review of IEPA air monitoring data in Granite City would be done on an annual basis.

An annual report would be prepared which would summarize the results of sampling conducted during the previous calendar year. The report would present the data obtained as well as an interpretation of that data.

The institutional controls pertinent to this alternative include site access restrictions, restrictive covenants, deed restrictions, property transfer restrictions, and private third-party agreements.

3.1.2 Alternative B

Taracorp Pile:	Multimedia Cap, Institutional Controls
Taracorp Drums:	Off Site Recovery at Secondary Lead Smelter
SLLR Piles:	Excavate and Consolidate with Taracorp Pile
Venice Alleys:	Asphalt or Sod Cover Based on Usage
Eagle Park Acres:	Vegetated Clay Cap, Institutional Controls
Area 1 Unpaved Surfaces:	Asphalt or Sod Cover Based on Usage
Area 2 Unpaved Surfaces:	Asphalt or Sod Cover Based on Usage
Area 3 Unpaved Surfaces:	Asphalt or Sod Cover Based on Usage
Monitoring:	Air and Groundwater Monitoring

To implement Alternative B, drums containing lead drosses and other production by products would be removed to an off site secondary lead smelter for lead recovery. Wastes contained in the SLLR piles would be consolidated into the Taracorp pile; the consolidated pile would be graded and capped with a multimedia cap. Figure 9 presents a typical section of the proposed cap as well as potential finished grades. Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would also be implemented.

Eagle Park Acres would be purchased and a vegetated clay cap meeting ARARs would be installed over the battery case material. Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would also be implemented.

Venice Alleys would be covered in accordance with present usage. Asphalt would be applied to those portions subject to vehicular or pedestrian use; the remaining areas would be covered with 3 inches of topsoil followed by sod.

Unpaved portions of Areas 1, 2, and 3 would be covered in accordance with present usage. Asphalt would be applied to unpaved driveways and alleys; grassed or open areas would be covered with three inches of topsoil followed by sod. Removal of existing soils would be limited to driveway subgrade preparation, therefore surface elevations would change somewhat depending on surface treatment. Any soil excavated would be transported to the Taracorp pile for use in grading prior to cap installation.

The air and groundwater monitoring included in the no action alternative would also be implemented as part of Alternative B.

3.1.3 Alternative C

Taracorp Pile:	Multimedia Cap, Institutional Controls
Taracorp Drums:	Off Site Recovery at Secondary Smelter
SLLR Piles:	Excavate and Consolidate with Taracorp Pile
Venice Alleys:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces

Eagle Park Acres:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces
Area 1 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 2 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 3 Unpaved Surfaces:	Asphalt or Sod Cover Based on Usage
Monitoring:	Air and Groundwater Monitoring

To implement Alternative C, drums containing lead drosses and other production by products would be removed to an off site secondary lead smelter for lead recovery. Wastes contained in the SLLR piles would be consolidated into the Taracorp pile; the consolidated pile would be graded and capped with a multimedia cap. Figure 9 presents a typical section of the proposed cap as well as potential finished grades. Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would also be implemented.

Battery case material would be excavated from both Venice Alleys and Eagle Park Acres and transferred to the Taracorp Pile. These areas would be restored with either asphalt or sod, in accordance with current usage.

Unpaved portions of Areas 1 and 2 would be excavated to a depth of three inches and restored with either asphalt or sod, in accordance with current usage. Excavated soil would be transported to the Taracorp Pile for use in grading prior to cap installation.

Unpaved portions of Areas 3 would be covered in accordance with present usage. Asphalt would be applied to unpaved driveways and alleys; grassed or open areas would be covered with three inches of topsoil followed by sod. Removal of existing soils would be limited to driveway subgrade preparation, therefore surface elevations would change somewhat depending on surface treatment. Any soil excavated would be transported to the Taracorp pile for use in grading prior to cap installation.

The air and groundwater monitoring included in the no action alternative would also be implemented as part of Alternative C.

3.1.4 Alternative D

Taracorp Pile:	Multimedia Cap, Institutional Controls
Taracorp Drums:	Off Site Recovery at a Secondary Lead Smelter
SLLR Piles:	Excavate and Consolidate with Taracorp Pile
Venice Alleys:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces
Eagle Park Acres:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces
Area 1 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 2 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 3 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Monitoring:	Air and Groundwater Monitoring

To implement Alternative D, drums containing lead drosses and other production by products would be removed to an off site secondary lead smelter for lead recovery. Wastes contained in the SLLR piles would be consolidated into the Taracorp pile; the consolidated pile would be graded and capped with a multimedia cap. Figure 9 presents a typical section of the proposed cap as well as potential finished grades. Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would be implemented.

Battery case material would be excavated from both Venice Alleys and Eagle Park Acres and transferred to the Taracorp Pile. These areas would be restored with either asphalt or sod, in accordance with current usage.

Unpaved portions of Areas 1, 2, and 3 would be excavated to a depth of three inches and restored with either asphalt or sod, in accordance with present usage. Excavated soil would be transported to the Taracorp Pile for use in grading prior to cap installation.

The air and groundwater monitoring included in the no action alternative would also be implemented as part of Alternative D.

3.1.5 Alternative E

Taracorp Pile:	Multimedia Cap, Supplemental Liner, Institutional Controls
Taracorp Drums:	Off Site Recovery at a Secondary Lead Smelter
SLLR Piles:	Excavate and Consolidate with Taracorp Pile
Venice Alleys:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces
Eagle Park Acres:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces
Area 1 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 2 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.

Area 3 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Monitoring:	Air and Groundwater Monitoring

To implement Alternative E, drums containing lead drosses and other production by products would be removed to an off site secondary lead smelter for lead recovery. An impermeable liner would then be installed on a section of Area 1 adjacent to the Taracorp pile. This section would be excavated to a depth of 3 inches prior to liner installation, with the excavated soil staged with the Taracorp pile. The liner would consist of 2 feet of clay, 1 foot of sand (secondary drainage layer), a 60 mil synthetic membrane, and 1 foot of sand (primary drainage layer). A primary and secondary leachate collection system (perforated PVC piping) would also be provided. Excavated soils from Areas 1, 2, and 3 would be placed over the primary drainage layer as a base to protect the liner from damage. Following liner construction, waste materials from the Taracorp Pile, SLLR piles, Eagle Park Acres, and Venice Alleys would be excavated, transported to and placed on the liner. These wastes would be covered and graded with soils excavated from the base of the former Taracorp Pile. A multimedia cap would then be installed over the consolidated pile. Figure 9 presents a typical section of the proposed cap; Figure 10 shows the proposed liner location. Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would also be implemented.

As discussed above, battery case material would be excavated from both Venice Alleys and Eagle Park Acres and transferred to the newly constructed liner. These areas would be restored with either asphalt or sod, in accordance with current usage.

Unpaved portions of Areas 1, 2, and 3 would be excavated to a depth of three inches and restored with either asphalt or sod, in accordance with present usage. As stated above excavated soil would be transported to the newly constructed liner and placed directly over the primary drainage layer, to protect the synthetic membrane from damage from heavy slag and debris.

Air and groundwater monitoring included in the no action alternative would be implemented as part of Alternative E.

3.1.6 Alternative F

Taracorp Pile:	Multimedia Cap, Supplemental Liner, Recovery of Plastic Battery Case Material and Lead, Institutional Controls
Taracorp Drums:	Off Site Recovery at a Secondary Lead Smelter
SLLR Piles:	Excavate and Consolidate with Taracorp Pile
Venice Alleys:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces
Eagle Park Acres:	Excavate Case Material and Consolidate with Taracorp Pile. Restore Surfaces
Area 1 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 2 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Area 3 Unpaved Surfaces:	Excavate Soil and Consolidate with Taracorp Pile. Restore Surfaces.
Monitoring:	Air and Groundwater Monitoring

To implement Alternative F, drums containing lead drosses and other production by products would be removed to an off site secondary lead smelter for lead recovery. An impermeable liner would then be installed on a section of Area 1 adjacent to the Taracorp pile. This section would be excavated to a depth of 3 inches prior to liner installation, with the excavated soil staged with the Taracorp pile. The liner would consist of 2 feet of clay, 1 foot of sand (secondary drainage layer), a 60 mil synthetic membrane, and 1 foot of sand (primary drainage layer). A primary and secondary leachate collection system would also be provided. Excavated soils from Areas 1, 2, and 3 would be placed over the primary drainage layer to protect it from damage. Following liner construction, processed waste materials from the Taracorp Pile, as well as excavated materials from the SLLR piles, Eagle Park Acres, and Venice Alleys, would be transported to the liner. These wastes would be covered and graded with soils excavated from the base of the former Taracorp Pile. A multimedia cap would then be installed over the consolidated pile. Figure 9 presents a typical section of the proposed cap; Figure 10 shows the proposed liner location. Institutional controls such as site access restrictions, restrictive covenants, deed restrictions, and property transfer restrictions would also be implemented.

Prior to transport to the newly constructed liner, waste materials in the Taracorp Pile would be processed to recover plastic battery case material and smeltable lead. During the initial excavation, waste materials would be visually segregated:

excavations containing primarily slag would be transported directly to the adjacent liner; those containing significant amounts of plastic battery case material and smeltable lead would be transported to an on-site segregation unit. The commercially available unit would utilize flotation as a recovery mechanism. Recovered plastic would be shipped off-site for use as a raw material. Recovered lead and lead oxide would be shipped to a secondary smelter after drying. Residuals, including slag and rubber case material, would be transported to the liner.

As discussed above, battery case material would be excavated from both Venice Alleys and Eagle Park Acres and transferred to the newly constructed liner. It is thought that these casings are primarily rubber, and therefore not likely suitable for recycling. If significant amounts of plastic casings are excavated, however, they would be processed in the same fashion as the Taracorp pile casings. Venice Alleys and Eagle Park surface areas would be restored with either asphalt or sod, in accordance with current usage.

Unpaved portions of Areas 1, 2, and 3 would be excavated to a depth of three inches and restored with either asphalt or sod, in accordance with present usage. As stated above, excavated soil would be transported to the newly constructed liner and placed directly over the primary drainage layer, to protect the synthetic membrane from damage from heavy slag and debris.

The air and groundwater monitoring included in the no action alternative would also be implemented as part of Alternative F.

3.1.7 Alternative G

Taracorp Pile:	Recovery of Plastic Battery Case Material and Lead, Disposal of Residuals in RCRA Landfill
Taracorp Drums:	Off Site Recovery at a Secondary Lead Smelter
SLLR Piles:	Disposal in RCRA Landfill
Venice Alleys:	Excavate Case Material, Disposal in RCRA Landfill. Restore Surfaces
Eagle Park Acres:	Excavate Case Material, Disposal in RCRA Landfill. Restore Surfaces.
Area 1 Unpaved Surfaces:	Excavate and Restore. Disposal in RCRA Landfill.
Area 2 Unpaved Surfaces:	Excavate and Restore. Disposal in Non-RCRA Landfill.
Area 3 Unpaved Surfaces:	Excavate and Restore. Disposal in Non-RCRA Landfill.
Monitoring:	Groundwater Monitoring

To implement Alternative G, drums containing lead drosses and other production byproducts would be removed to an off site secondary lead smelter for lead recovery. The remaining waste materials in the Taracorp Pile would be excavated, processed to recover recyclable plastic, and disposed of in a RCRA landfill.

Processing would consist of visual segregation during initial excavations to separate non plastic bearing wastes from wastes containing plastics. Non plastic bearing waste would be transported directly to the RCRA landfill; those containing significant amounts of plastic battery case material and smeltable lead would be transported to an on-site segregation unit. The commercially available unit would utilize flotation as a recovery mechanism. Recovered plastic would be shipped off-site for use as a raw material. Recovered lead and lead oxide would be shipped to a secondary smelter after drying. Residuals, including slag and rubber case material, would be transported to the RCRA landfill.

Battery case material would be excavated from both Venice Alleys and Eagle Park Acres and transported directly to the RCRA landfill. It is thought that these casings are primarily rubber, and therefore not likely suitable for recycling. If significant amounts of plastic casings were excavated, however, they would be processed in the same fashion as the Taracorp pile casings. Venice Alleys and Eagle Park Acres surface areas would be restored with either asphalt or sod, in accordance with current usage.

Unpaved portions of Areas 1, 2, and 3 would be excavated to a depth of three inches and restored with either asphalt or sod, in accordance with present usage. Excavated soil from Area 1 would be transported to a RCRA landfill; excavated soil from Areas 2 and 3 would be transported to a non-RCRA landfill.

The groundwater monitoring included in the no action alternative would also be implemented as part of Alternative G. Long term air monitoring would not be required.

3.2 Screening of Alternatives

The intent of the screening of alternatives step is to eliminate alternatives that are significantly less implementable or more costly than comparably effective alternatives. The screening is conducted on the basis of effectiveness, ease of implementation, and cost.

The factors included under the criterion of effectiveness are a) overall reduction in toxicity, mobility or volume of waste; b) long-term effectiveness and permanence; c) short-term impacts which the alternatives may pose during implementation; and d) how quickly protection can be achieved. Alternatives that do not protect human health and the environment to an acceptable degree are not carried through this initial screening of alternatives, with the possible exception of the no-action alternative (Alternative A). The no-action alternative will be carried through to the detailed analysis step without prior screening, as a baseline for comparison with other alternatives, regardless of the degree of protectiveness it offers.

Implementability is associated with the difficulty in constructing, operating and maintaining a particular alternative. The performance of a remedial action is subject to a number of technical, administrative and logistical issues. These factors are assessed to characterize the implementability of each alternative. An alternative which would be more difficult or time consuming to implement than a comparably effective remedy would not be carried through this initial screening.

Cost factors include costs necessary to perform a remedial action, and any operating and maintenance costs associated with an action. Cost is used to eliminate alternatives which provide a similar degree of protectiveness at a significantly greater cost.

3.2.1 Effectiveness

Each remedial action alternative (B,C,D,E,F,G) would result in the elimination of unacceptable risk to humans and the environment through a combination of containment and treatment technologies. All remedial response objectives would be achieved by each alternative.

Alternative B represents an in-situ containment alternative. As the site is not located within a flood plain, containment of contaminated materials within the capped Taracorp pile would eliminate the potential for direct contact with contaminants and virtually eliminate the potential for transport of contaminants by ground or surface water. The potential for migration of metals would be limited by:

- the installation of a multimedia cap which would eliminate run-on and direct contact of precipitation with the pile;
- the high alkalinity of the ground water;
- the low solubility of metal carbonates; and
- cation exchange within the unconsolidated deposits.
- the clay barrier (10^{-7} to 10^{-8} cm/sec) beneath most of the existing pile

The installation of a multimedia cap over the contaminated materials would also eliminate the potential for direct contact with or migration of contaminants via the air pathway. In addition, capping in-situ would reduce the potential for short term impact to human health and the environment caused by the generation of contaminated dust. Air modeling conducted for another site involving battery case material (Dames & Moore, 1988) concluded that for alternatives involving large scale excavation of materials "substantial on-site controls would be necessary and there is a possibility that even maximal management controls on-site would not prevent excessive short term off-site impacts".

The installation of caps over waste materials at Eagle Park Acres (vegetated clay) and Venice Alleys (asphalt) would virtually eliminate the potential for direct contact with waste materials and would limit the potential for migration of contaminants off-site. Installation of cover (asphalt or three inches of topsoil plus sod) over contaminated soils in Areas 1, 2, and 3 would effectively limit the migration of contaminants and limit the potential for direct contact with contaminants.

The in-situ containment specified by Alternative B could be implemented in a relatively short period of time, as standard construction techniques would be utilized, and as excavation would be limited.

Alternative C provides an additional level of protection to human health and the environment at Eagle Park Acres, Venice Alleys, Area 1 and Area 2. Implementation of Alternative C requires the excavation of waste materials and contaminated soils from these areas and consolidation of the materials into the Taracorp pile. The potential for migration of contaminants offsite, or for direct contact with contaminants in these areas, therefore, is eliminated. In addition, consolidating contaminated materials facilitates the implementation of institutional controls, which may not be as effectively implemented at multiple remote sites.

The potential for short term impact to human health and the environment caused by generation of contaminated dust could be greater during implementation of Alternative C than Alternative B. Appropriate dust control and respiratory protective measures would be required.

Alternative C would require more time to implement than Alternative B, as excavation is required. The additional time, however, would not be expected to be significant, as mobilization, clearing, and installation of cover is common to both alternatives.

Alternative D extends the additional protection provided by excavation and consolidation of contaminated soils to Area 3. It should be noted that both methods, i.e. cover versus excavation and consolidation, are effective in limiting human contact with contaminated materials and in limiting the potential for transport of materials off-site. The increased margin of effectiveness afforded by excavation and consolidation decreases as contaminant concentration in soil decreases. This margin of effectiveness will require close examination during the detailed evaluation of alternatives.

Alternative D would require slightly more time to implement than Alternative C.

Alternatives E, F, and G differ from Alternative D only in their treatment of the Taracorp pile. They provide the same highly effective level of protection afforded by excavation and consolidation to Eagle Park Acres, Venice Alleys, and Areas 1, 2, and 3 as does Alternative D.

Implementation of Alternative E requires the use of a bottom liner beneath the Taracorp pile. The use of such a liner would prove highly effective in eliminating the potential migration of contaminants. As discussed above, however, a multimedia cap alone was judged effective in eliminating the potential migration of contaminants. The increased margin of effectiveness provided by the bottom liner, therefore, will require close examination during the detailed evaluation of alternatives.

Implementation of Alternative E would require excavation of over 85,000 cubic yards of contaminated material at the Taracorp site. Such excavation could increase the potential for short term impact to human health and the environment caused by generation of contaminated dust. Effective control of such dust could be beyond the capability of present technology; effective controls would have to be developed. The surface area of exposed waste materials would also increase during implementation of the alternative, increasing the risk of contaminant migration off-site due to run-off. Appropriate controls would be required.

Alternative E would be expected to require much more time to implement than Alternative D, due to bottom liner construction and excavation requirements.

<u>Implementation of Alternative F</u> would require the excavation and segregation of the Taracorp pile, including significant manual segregation. The material handling required by this alternative increases the potential for short term impact to human health by both direct ingestion of contaminated materials and inhalation of

generated dusts. The ability to control air emissions during excavation is questioned based on past experience at the site during St. Louis Lead Recycling's operations and air modeling described previously. The effectiveness of this alternative to reduce the volume of waste materials is also questioned; calculations indicate that volume reduction would be approximately 10%. As this alternative includes excavation and a bottom liner for disposal of waste materials, issues discussed above pertaining to Alternative E also apply.

Of all alternatives (A-G), Alternative F would be expected to take the longest amount of time to effect remediation, due to segregation requirements, processing requirements, and bottom liner construction.

Alternative G represents an off-site disposal alternative. As such, excavation and segregation of the Taracorp pile would be required, with the associated potential for short term impact to human health and the environment. As a final disposal option, off-site disposal in a RCRA landfill would be a highly effective method of eliminating direct contact and uncontrolled migration of contaminants. The increased margin of benefit obtained over in-situ containment, however, will require close examination during the detailed evaluation of alternatives. As the alternative includes excavation, recovery, and recycling, the issues discussed pertaining to Alternatives E and F also apply.

In summary, Alternatives B, C, and D are equally effective with respect to the Taracorp pile, and progressively more effective with respect to the remote areas. As increasing amounts of excavation are required by each, the potential for short term impact to human health and the environment increases, as well as the time required to effect remediation. The time and risk associated with Alternatives B, C, and D, however, do not vary significantly.

Alternatives D, E, F, and G are equally effective with respect to the remote areas, and differ in effectiveness only with respect to the Taracorp pile. Compared to Alternative D, Alternative E is possibly more effective, but significantly more time consuming. Alternative F is of questionable increased effectiveness, as only 10% volume reduction is obtained with significant increase of both time and human exposure to contaminants. Alternative G is effective as a final disposal option, but is also lengthy with significant increase of potential for short term impact to human health and the environment.

3.2.2 Implementability

The excavation, consolidation, capping, and bottom liner installation incorporated into some or all of the alternatives utilize demonstrated procedures and standard construction equipment. These procedures, therefore, do not limit the implementation of any alternative. It should be noted, however, that excavation and restoration of residential and commercial neighborhoods will require significant manual labor due to the small working areas expected.

Recycling of residues from lead furnaces is a technically feasible operation performed at commercial facilities. The number of secondary lead smelters is limited, however, and most are interested in smelting products with sufficient lead content to be economically attractive. The contained drosses, which have a higher lead content than other waste materials, may be acceptable to secondary smelters, as a lead content of 27% is often considered a common minimum cutoff for acceptance. Recycling of the drummed drosses as incorporated into all remedial alternatives would be implemented if a secondary smelter willing to accept the drummed material is located. Otherwise, the drummed drosses would be addressed in the same fashion as the other pile material. The volume of drummed material is not expected to impose time constraints. Lead recovered from the recycling operation incorporated into Alternatives F and G would be addressed similarly.

Given the above analysis, Alternatives B, C, D, and E are expected to be readily implementable.

Alternatives F and G require the segregation and recovery of recyclable plastics and lead from the waste piles. Equipment is readily available to recover casings and lead from batteries; however, utilization of this equipment to recover casings and lead from the blast furnace slag/casing/metallic lead mixture present in the Taracorp pile is questionable. Blast furnace slag would require hand picking from the recovery equipment feed belt, as the recovery equipment is not designed to process materials harder than lead with linear dimensions exceeding 1 inch. Any slag or debris that does enter the equipment (linear dimensions less than 1 inch) would contaminate the recovered lead, and limit its acceptability as a smeltable material. It should be noted that when this equipment is used to break batteries alone (ideal conditions), the recovered smeltable product is generally only 50-60% lead. There are also limitations with respect to the recycling of plastic battery casings. Plastic casings, which have been exposed to and damaged by sunlight, as a portion of those at the Taracorp pile likely are, are unsuitable as a raw material in the plastics industry. In addition, pilot studies conducted for a similar superfund site (Gould, Inc. Site, EPA Docket Number 1085-05-08-106) indicated that the recovered plastics failed the TCLP test for lead, despite various rinsing schemes. For all these reasons, therefore, the implementability of the recovery portion of Alternatives F and G is questionable.

Alternative G requires the off-site disposal of waste materials in a RCRA landfill. Although the excavation and transport of waste materials is readily implementable, the landfill ban for characteristic wastes expected to be imposed in 1991 could have implications for material which does not pass the TCLP test. This concern will be evaluated in the detailed analysis of alternatives.

In summary, alternatives B, C, D, and E are readily implementable, while the implementability of the recovery/recycling portion of Alternatives F and G is questionable. Land disposal restrictions may or may not affect the implementability of Alternative G.

3.2.3 Cost

Preliminary remedial cost estimates including capital and annual operation costs were developed for each alternative, and are included as Tables 14 - 20. The total cost of implementing each alternative is as follows:

Alternative	Total Cost
A	$ 475,110
B	$ 5,685,020
C	$ 6,471,000
D	$ 6,835,450
E	$13,065,890
F	$27,333,930
G	$50,353,680

3.2.4 Summary

All alternatives will be evaluated in detail in Section 4.

SECTION 4 - DETAILED EVALUATION OF ALTERNATIVES

4.1 Introduction

The detailed analysis conducted during the evaluation of alternatives provides the basis for remedial alternative selection. Alternatives are evaluated with respect to nine criteria (USEPA, 1988 b) (USEPA, 1988 c), which are discussed below.

4.1.1 Protection of Human Health and the Environment

The assessment of the alternative against this criterion describes how the alternative, as a whole, protects human health and the environment.

4.1.2 Compliance with ARARs

The assessment of alternatives against this criterion evaluates the compliance of alternatives with ARARs, or the requirement for and justification of a waiver. The assessment includes information from advisories, criteria, and guidance that lead and support agencies have agreed is necessary and appropriate. Specific factors include:

- Compliance with chemical specific ARARs
- Compliance with action specific ARARs
- Compliance with location specific ARARs
- Compliance with other criteria, advisories, and guidance

4.1.3 Long Term Effectiveness and Permanence

The assessment of alternatives against this criterion evaluates the long term effectiveness of alternatives in protecting human health and the environment after response objectives have been met. Specific factors include:

- Magnitude of remaining risk
- Adequacy of controls
- Reliability of controls

4.1.4 Reduction of Toxicity, Mobility, and Volume

The assessment of alternatives against this criterion evaluates the anticipated performance of the specific treatment technologies. Specific factors include:

- The treatment processes, the remedies they will employ, and the materials they will treat
- The amount of hazardous materials that will be destroyed or treated, including how principal threats will be addressed
- The degree of expected reduction in toxicity, mobility, or volume measured as a percentage of reduction (or order of magnitude)
- The degree to which the treatment will be irreversible
- The type and quantity of treatment residuals that will remain following treatment

4.1.5 Short Term Effectiveness

The assessment of alternatives against this criterion evaluates the effectiveness of alternatives in protecting human health and the environment during the construction and implementation period until response objectives have been met. Specific factors include:

- Protection of the community during remedial action
- Protection of workers during remedial action
- Environmental impacts
- Time until remedial response objectives are met

4.1.6 Implementability

The assessment of alternatives against this criterion evaluates the technical and administrative feasibility of alternatives and the availability of required resources. Specific factors include:

- Ability to construct and operate the technology
- Reliability of the technology
- Ease of undertaking additional remedial action if necessary
- Ability to monitor effectiveness of remedy
- Ability to obtain approvals from other agencies
- Coordination with other agencies
- Availability of offsite treatment, storage, and disposal services and capacity
- Availability of necessary equipment and specialists
- Availability of prospective technologies

4.1.7 Cost

Alternative costs are evaluated during this assessment. Specific factors include:

- Capital costs
- Operating and maintenance costs
- Present worth costs

4.1.8 State Acceptance

This criteria presents preliminary examination of the state's (or supporting agency's) apparent preferences or concerns over alternatives. The analysis should be limited to formal comments made during previous phases of the RI/FS. Alternatives will be evaluated against this criteria when such comments have been received.

4.1.9 Community Acceptance

This criteria presents a preliminary examination of the community's apparent preferences or concerns over alternatives, when such input has been documented. Alternatives will be evaluated against this criteria after such input has been received.

Summary

The seven remedial alternatives to be evaluated are presented on Table 13. In the following sections, these alternatives will be individually evaluated against the above criteria. Following this individual evaluation, a criteria by criteria comparison between the alternatives will be conducted. As a preview to text, the results of detailed evaluation and comparison are summarized on Table 21.

4.2 Alternative A

The No Action Alternative (A) includes a group of activities that would be used to monitor contaminant migration. A wide variety of institutional controls would also be implemented.

4.2.1 Protection of Human Health and the Environment

The No Action Alternative does not address all receptor pathways determined to be complete in the Risk Assessment of the Remedial Investigation. This risk assessment, however, identified no unacceptable impacts to human health from lead on the site or in the surrounding community. This conclusion was supported by blood lead analysis conducted by the Illinois Department of Health during 1982 and 1983. Alternative A, therefore, is evaluated as being protective of human health and the environment.

4.2.2 Compliance with ARARs

Chemical Specific ARARs

The following chemical specific ARARs would apply to Alternative A:

PCBRR's; Title 35; EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243: Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead. (Ambient Air Quality Standard for Lead = 1.5 ug/m^3)

Occupational Safety and Health Administration (OSHA) 29 CFR 1910. (Permissible Exposure Limit for Lead = 50 ug/m^3)

PCBRR's; Title 35; EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 302: Water Quality Standards; Subpart B: General Use Water Quality Standards; Section 302.208: Chemical Constituents.

The remedial action required by Alternative A would comply with these ARARs, as construction activities would be limited to fencing.

Action Specific ARARs

No action at the pile would leave the existing pile of characteristic hazardous waste uncovered. This is inconsistent with hazardous waste management ARARs described in more detail below.

Location Specific ARARs

No location specific ARARs have been identified for Alternative A.

4.2.3 Long Term Effectiveness

The overall long term effectiveness of the No Action Alternative is considered low, as it leaves in place varying concentrations of lead contaminated soils and waste materials in industrial, commercial, and residential areas.

Where implemented, the institutional controls required by the alternative would be very effective in limiting direct contact with waste materials and contaminated soils. Long-term management requirements would be limited to fence repair and enforcement of access restrictions. It is not certain, however, that institutional controls could be adequately maintained and enforced at Eagle Park Acres. Moreover, institutional controls would not be implemented at Venice Alleys, Area 2, or Area 3, where the risk of direct contact is significant.

4.2.4 Reduction of Toxicity, Mobility, or Volume

The No Action Alternative, by definition, does not reduce the toxicity, mobility, or volume of contaminants.

4.2.5 Short Term Effectiveness

As contaminants would be left in place during implementation of the No Action Alternative, short term impact to the community, workers, and the environment would be expected to be minimal. The institutional controls and monitoring required by this alternative could be implemented in less than 12 months.

4.2.6 Implementability

Monitoring and access restrictions required by the no action alternative are easily implementable using standard techniques. The deed restrictions and restrictive covenants required are also implementable, but possibly not immediately so, due to the careful legal review required.

Implementation of the No Action Alternative would in no way hinder the undertaking of additional remedial actions, if such actions are deemed necessary.

4.2.7 Cost

The No Action Alternative is by far the least costly alternative to implement. Total capital costs are estimated at $99,200. Total annual operating costs are estimated at $21,550 (no adjustment for inflation). Total present worth for 30 years operation assuming 5% interest is estimated at $475,110. The detailed cost estimate for Alternative A is presented as Table 14.

4.3 Alternative B

Under Alternative B, containerized drosses would be removed from the Taracorp Pile and recycled at a secondary smelter. Wastes contained in the Taracorp Pile would be capped in place using a multimedia cap. Contaminated materials at the Venice Alleys would be contained beneath 3 inches of asphalt pavement or 3 inches of topsoil followed by sod. A vegetated clay cap would be used to contain wastes at Eagle Park Acres. Unpaved portions of Areas 1, 2, and 3 would either be paved or covered with 3 inches of sod followed by topsoil, as appropriate.

4.3.1 Protection of Human Health and the Environment

With respect to the Taracorp pile, Alternative B is evaluated as being protective of human health and the environment, as it would eliminate contaminant migration (via ground water, surface water, or air pathway), and would eliminate the potential for direct contact with contaminants.

With respect to the remote areas, Alternative B is also evaluated as being protective of human health and the environment. Long term protection of human health and the environment, however, especially with respect to the topsoil/sod cover over vegetated areas, cannot be insured without proper maintenance of such cover. Periodic inspections would be required.

4.3.2 Compliance with ARARs

Chemical Specific ARARs

The following chemical specific ARARs would apply to Alternative B:

PCBRR's; Title 35; EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243: Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead. (Ambient Air Quality Standard for Lead = 1.5 ug/m^3)

Occupational Safety and Health Administration (OSHA) 29 CFR 1910. (Permissible Exposure Limit for Lead = 50 ug/m^3)

PCBRR's; Title 35; EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 302: Water Quality Standards; Subpart B: General Use Water Quality Standards; Section 302.208: Chemical Constituents.

The remedial action required by Alternative B would comply with these ARARs, as wastes and contaminated soils would be left in place. Some dust monitoring and control, however, would be required during grading and consolidation activities at the Taracorp Pile.

Action Specific ARARs

The following action specific ARARs would apply to Alternative B:

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 725: Interim Status Standards for Owners and Operators of Hazardous Waste TSD Facilities; Subpart N: Landfills; Section 725.410: Closure and Post Closure.

The Taracorp Pile multimedia cap could be constructed to meet the requirements of this ARAR as described in Appendix A.

Location Specific ARARs

No location specific ARARs have been identified for Alternative B.

4.3.3 Long Term Effectiveness

The overall long term effectiveness of Alternative B is considered excellent at the Taracorp Pile, and fair at the remote areas.

Taracorp Pile

The remedial action prescribed by Alternative B at the Taracorp pile, including the SLLR piles and the contained drosses, is considered to be highly effective in the long term. The containerized drosses would be removed and recycled. Although the magnitude or toxicity of the slag and battery casings would not be reduced, the long term risks to human health and the environment would be greatly reduced by capping the piles in place. Capping is a proven method of long term containment of both municipal and industrial wastes. It would meet all remedial objectives, including eliminating the potential of direct contact with waste materials, eliminating the potential for migration of contaminated dust, and limiting the migration of metals to ground water. A computer model predicted a 99.99% reduction in percolation through the multimedia cap. Modeling results are shown in Appendix A.

Long term management of the cap would be required to insure adequate performance. Such management would include regular mowing, as well as reseeding and fertilization when required. If the vegetative cover were not properly maintained, cap repair (soil augmentation) could be required. Required monitoring would include semiannual ground water monitoring and semiannual air sampling. A quarterly cap inspection would also be required. No difficulties would be expected to be encountered implementing maintenance or monitoring requirements.

If properly constructed and maintained, the likelihood that the in-situ cap would require replacement is minimal. As the Taracorp piles have been in place for some time, settling, with the subsequent detrimental effects to cap integrity, would not be expected. In the unlikely event of cap failure, however, institutional controls would remain in place to guard against direct contact, and repair or replacement could be effected promptly to minimize dust generation or ground water contamination. The magnitude of such impact would also be minimized by the industrial location of the site.

Remote Areas

The remedial actions prescribed for the remote areas are evaluated as being fair in long term effectiveness. Upon completion of remediation, although the magnitude of wastes or their toxicity would not be reduced, all remedial objectives would be met through implementation of in-situ containment in the remote areas. These objectives include eliminating the potential for direct contact and reducing the potential for inhalation of contaminated dust. In-situ containment in the remote areas is evaluated as being fair, however, because long term maintenance and integrity of the containment media can not be insured in these residential and commercial areas. The primary threat to containment media integrity would be future excavation, particularly in Areas 2 and 3, where homeowners are likely to garden and make other improvements to their property. As stated in the screening of alternatives, institutional controls can not be as effectively implemented in these areas. It should be noted, however, that controls limiting excavation could be effectively implemented at Eagle Park Acres, Venice Alleys, and Area 1.

Long term maintenance of the containment media centers primarily on the maintenance of the vegetated clay cap at Eagle Park Acres and as well as all topsoil/sod covers. For the cap at Eagle Park Acres, the maintenance requirements discussed above under the Taracorp pile would apply. Site access restrictions, however, would be difficult to maintain, and possible cap damage from children and pedestrians can not be ruled out. The topsoil/sod covers utilized elsewhere would require considerable maintenance to remain effective, however, the 3 inches of topsoil included in the method would significantly mitigate the effects of sod failure. Maintenance of asphalt covers would be expected to be minimal. Although cracking of asphalt covers could be expected due to age and wear, such cracking would not expose contaminants to humans or the environment. The asphalt covers include sub-base material and 3 inches of asphalt.

The monitoring required in the remote areas would primarily consist of cover integrity inspections. Cover replacement could be conducted in those areas where sod failure has resulted.

4.3.4 Reduction of Toxicity, Mobility, or Volume

Implementation of Alternative B requires the removal and recycling of contained drosses at the Taracorp Pile. The toxicity and volume of these drosses, therefore, would be eliminated.

At the Taracorp pile, in-situ containment would significantly reduce the mobility of contaminants, because the installation of a multimedia cap would eliminate run-on and direct contact of precipitation with the waste materials, and waste materials would not be subject to wind scour. The high alkalinity of the ground water, the low solubility of metal carbonates, and cation exchange within the unconsolidated deposits would also function to limit contaminant mobility.

A vegetated clay cap at Eagle Park Acres, asphalt pavement at Venice Alleys, and asphalt pavement of the unpaved alleys and driveways in Areas 1, 2, and 3 would significantly reduce contaminant mobility. A topsoil and sod cover would limit contaminant mobility via the air pathway and via surface runoff. Such cover, however, would not significantly reduce contaminant mobility via percolating ground water. For the reasons discussed earlier, however, such ground water related mobility is thought to be minimal.

4.3.5 <u>Short Term Effectiveness</u>

As contaminants would be left in place during implementation of Alternative B, with the exception of excavation required to prepare pavement subbases or to maintain grades in selected areas, the potential for short term impact to the community, workers, and the environment would be expected to be minimal. Dust monitoring and control would be required at all excavations and during consolidation (SLLR piles), grading, and capping operations at Taracorp pile. A health and safety plan would address dust monitoring and control requirements, as well as worker and public safety concerns related to the construction activities required to implement the alternative.

The institutional controls and monitoring required by this alternative could be implemented in a relatively short period of time. Consolidation and capping activities at the Taracorp pile could be expected to take six to twelve months; containment activities at Venice Alleys and Eagle Park Acres one to three months each; coverage of Area 1 two to four months; and coverage of Areas 2 and 3 six to eight months each. Actual remediation times would depend largely on the degree of mobilization. Although many of the above activities could be conducted concurrently, most activities would be restricted to the spring, summer, and autumn. Alternative B therefore, would be expected to require one to two years to complete. This time estimate does not include time required to prepare plans and specifications, or obtain necessary construction permits.

4.3.6 Implementability

With the exception of contained drosses on the Taracorp pile, Alternative B can be implemented entirely using standard construction techniques. Given the size of the metropolitan St. Louis area, mobilizing suitable construction equipment and operators would not be anticipated to be difficult. Heavy equipment would be required to consolidate the SLLR piles with the Taracorp pile; dust monitoring and control measures would be also implemented. Multimedia caps are also installed using standard construction techniques, although care must be given to the installation of the synthetic membrane. Light equipment and manual labor would be required to cover vegetated residential and commercial portions of Areas 2 and 3 with topsoil and sod. It should be noted that work in these areas could be slow due to their confined nature and the requirement to relocate incidentals (both public and private facilities, fixtures, and small structures).

The contained lead drosses would be removed from the pile and shipped to a secondary lead smelter. At least one smelter has shown some interest in these materials. If, however, a smelter could not be found to accept the materials (D. Mickey, 1989), they would be included within the Taracorp pile multimedia cap.

Additional remedial actions would not be anticipated with respect to the Taracorp piles should Alternative B be implemented. Additional remedial action could be required, however, in those contaminated areas covered by pavement, topsoil and sod, if these covers were not properly maintained by owners. Such additional action could be implemented with the same level of effort as initial installment.

Monitoring and access restrictions required by Alternative B are implementable. Cap and cover inspections could be conducted with little or no difficulty. Periodic surface soil sampling could also be conducted to monitor the effects of possible cover erosion and upward migration of contaminants by frost upheaval. It should be noted, however, that frost upheavel effects would be mitigated by the 3 inches of topsoil included with the cover. The deed restrictions and restrictive covenants required are also implementable, but possibly not immediately so, due to the careful legal review required.

4.3.7 Cost

Alternative B is the least costly remedial alternative to implement, with the exception of No Action Alternative. Total capital costs are estimated at $5,142,390. Total annual operating costs are estimated at $35,300 (no adjustment for inflation). Total present worth for 30 years operation assuming 5% interest is estimated at $5,685,020. A detailed cost estimate for Alternative B is presented as Table 15.

4.4 Alternative C

Under Alternative C, containerized drosses would be removed from the Taracorp Pile and recycled at a secondary smelter. Wastes contained in the Taracorp Pile would be capped in place using a multimedia cap. Contaminated materials at Eagle Park Acres and Venice Alleys, and contaminated soils at Areas 1 and 2, would be excavated and consolidated into the Taracorp Pile prior to multimedia capping. Unpaved portions of Area 3 would either be paved or covered with 3 inches of sod followed by topsoil, as appropriate.

4.4.1 Protection of Human Health and the Environment

With respect to the Taracorp pile, Alternative C is evaluated as being protective of human health and the environment, as it would eliminate contaminant migration (via ground water, surface water, or air pathway), and would eliminate the potential for direct contact with contaminants.

Alternative C is also evaluated as being protective of human health and the environment at Eagle Park Acres, Venice Alleys, Area 1, and Area 2, as contaminants would be removed from these areas.

At Area 3, Alternative C is evaluated as being protective of human health and the environment. Periodic monitoring and cover inspection would be required. However, at the lead concentrations in Area 3 soils, the effects of cover failure would not cause significant impacts to human health and the environment.

4.4.2 Compliance with ARARs

Chemical Specific ARARs

The following chemical specific ARARs would apply to Alternative C:

> PCBRR's; Title 35; EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243: Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead. (Ambient Air Quality Standard for Lead = 1.5 ug/m^3)

> Occupational Safety and Health Administration (OSHA) 29 CFR 1910. (Permissible Exposure Limit for Lead = 50 ug/m^3)

> PCBRR's; Title 35; EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 302: Water Quality Standards; Subpart B: General Use Water Quality Standards; Section 302.208: Chemical Constituents.

The remedial action required by Alternative C comply with these ARARs. Dust control and monitoring would, however, be required at all excavations and material handling locations.

Action Specific ARARs

The following action specific ARARs would apply to Alternative C:

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201; Permits and General Provisions; Subpart C; Prohibitions; Section 201.141: Prohibition of Air Pollution.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 212; Visual and Particulate Matter Emissions; Subpart K: Fugitive Particulate Matter.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243; Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 721: Identification and Listing of Hazardous Wastes.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 723: Standards Applicable to Transporters of Hazardous Waste.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 725: Interim Status Standards for Owners and Operators of Hazardous Waste TSD Facilities; Subpart N: Landfills.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; and Chapter II: EPA; 35 IAC Part 809: Special Waste Hauling, Subparts B-G.

The Taracorp Pile multimedia cap could be constructed to meet the requirements of these ARARs. Remote area excavation and transportation of wastes and contaminated soils could also be conducted in accordance with these ARARs. Dust monitoring and control, however, would be required.

Location Specific ARARs

No location specific ARARs have been identified for Alternative C.

4.4.3 Long Term Effectiveness

The overall long term effectiveness of Alternative C is considered excellent at the Taracorp Pile; excellent at Venice Alleys, Eagle Park Acres, Area 1, and Area 2; and good at Area 3.

Taracorp Pile

The remedial action prescribed by Alternative C at the Taracorp pile, including the SLLR piles and the contained drosses, is considered to be highly effective in the long term. The containerized drosses would be removed and recycled. Although the magnitude or toxicity of the slag and battery cases would not be reduced, the long term risks to human health and the environment would be greatly reduced by capping the piles in place. Capping is a proven method of long term containment of both municipal and industrial wastes. It would meet all remedial objectives, including eliminating the potential of direct contact with waste materials, eliminating the potential for migration of contaminated dust, and limiting the migration of metals to ground water. A computer model predicted a 99.99% reduction in percolation through the multimedia cap. Modeling results are shown in Appendix A.

Long term management of the cap would be required to insure adequate performance. Such management would include regular mowing, as well as reseeding and fertilization when required. If the vegetative cover were not properly maintained, cap repair (soil augmentation) could be required. Required monitoring would include semiannual ground water monitoring and semiannual air sampling.

A quarterly cap inspection would also be required. No difficulties would be expected to be encountered implementing maintenance or monitoring requirements.

If properly constructed and maintained, the likelihood that the in-situ cap would require replacement is minimal. As the Taracorp piles have been in place for some time, settling, with the subsequent detrimental effects to cap integrity, would not be expected. In the unlikely event of cap failure, however, institutional controls would remain in place to guard against direct contact, and repair or replacement could be effected promptly to minimize dust generation or ground water contamination. The magnitude of such impact would also be minimized by the industrial location of the site.

Venice Alleys, Eagle Park Acres, Area 1, Area 2

The remedial actions prescribed for Venice Alleys, Eagle Park Acres, Area 1, and Area 2 are evaluated as being excellent in long term effectiveness, as contaminanted soils and materials would be removed. The removal prescribed would eliminate the necessity for long term monitoring or maintenance in these areas.

Area 3

The remedial actions prescribed for Area 3 are evaluated as being good in long term effectiveness. All remedial objectives could be met through implementation of in-situ containment in Area 3, including eliminating the potential for direct contact and reducing the potential for inhalation of contaminated dust. Although the toxicity or volume of the contaminated soil would not be reduced, it should be noted that soil samples in Area 3 contained less than 1,000 ppm lead. The long term risk posed by future excavation of covered areas or the exposure of contaminated soils due to poor maintenance of cover, therefore, is not significant. This fact does not relax the requirements for periodic cover inspection and proper maintenance of cover. Such inspection and maintenance, however, is not as critical to long term effectiveness as would be for soils with higher concentrations of lead. In addition, the three inches of topsoil applied over vegetated areas before sod would mitigate the effects of possible sod failure.

4.4.4 Reduction of Toxicity, Mobility, or Volume

Implementation of Alternative C requires the removal and recycling of contained drosses at the Taracorp Pile. The toxicity and volume of these drosses, therefore, would be eliminated.

At the Taracorp pile, in-situ containment would significantly reduce the mobility of contaminants, because the installation of a multimedia cap would eliminate run-on and direct contact of precipitation with the waste materials, and waste materials would not be subject to wind scour. The high alkalinity of the ground water, the low solubility of metal carbonates, and cation exchange within the unconsolidated deposits would also function to limit contaminant mobility.

Contaminant mobility would be eliminated at Eagle Park Acres, Venice Alleys, Area 1, and Area 2, since contaminants in these areas would be removed.

Asphalt pavement over unpaved alleys and driveways in Area 3 would significantly reduce contaminant mobility. A topsoil and sod cover would limit contaminant mobility via the air pathway and via surface runoff. Such cover, however, would not significantly reduce contaminant mobility via percolating ground water. For the reasons discussed earlier, however, such ground water related mobility is thought to be minimal.

4.4.5 Short Term Effectiveness

Alternative C requires the excavation of contaminated materials and soils from Eagle Park, Venice Alleys, Area 1, and Area 2. Such excavation would create the risk of potential short term impact to human health and the environment by potentially generating contaminated dust. Dust monitoring and control therefore, would be required at all excavations and during consolidation, grading, and capping operations at Taracorp pile. A health and safety plan would address dust monitoring and control requirements, as well as worker and public safety concerns related to the construction activities required to implement the alternative.

The institutional controls and monitoring required by this alternative could be implemented in a relatively short period of time. Consolidation and capping activities at the Taracorp pile could be expected to take six to twelve months; excavation and restoration activities at Venice Alleys two to four months; Eagle Park one to three months; Area 1 two to four months, Area 2 eight to twelve months; and cover of Area 3 six to eight months. Actual remediation times would depend largely on the degree of mobilization. Although many of the above activities could be conducted concurrently, most activities would be restricted to the spring, summer, and autumn. Alternative C therefore, would be expected to require one to two years to complete. This time estimate does not include time required to prepare plans and specifications, or obtain necessary construction permits.

4.4.6 Implementability

With the exception of the contained drosses on the Taracorp Pile, Alternative C can be implemented entirely using standard construction techniques. Given the size of the metropolitan St. Louis area, mobilizing suitable construction equipment and operators would not be anticipated to be difficult. Heavy equipment would be required to consolidate the SLLR piles with the Taracorp pile; dust monitoring and control measures would be also implemented. Multimedia caps are also installed using standard construction techniques, although care must be given to the installation of the synthetic membrane. Heavy equipment, light equipment, and manual labor would be required to excavate and restore Eagle Park Acres, Venice Alleys, Area 1, and Area 2. Dust monitoring and control measures would be required. Light equipment and manual labor would be required to cover vegetated residential and commercial portions of Areas 3 with topsoil and sod. It should be noted that work in Area 2 and 3 could be slow due to their confined nature and the requirement to relocate incidentals (both public and private facilities, fixtures, and small structures).

The contained lead drosses would be removed from the pile and shipped to a secondary lead smelter. At least one smelter has shown some interest in these materials (D. Mickey, 1989). If, however, a smelter could not be found to accept the materials, they would be included within the Taracorp pile multimedia cap.

Additional remedial actions would not be anticipated should Alternative C be implemented, with the possible exception of soils in Area 3 covered by pavement, topsoil and sod, if these covers are not properly maintained by owners. Such additional action could be implemented with the same level of effort as initial installment. As discussed above, however, soil lead concentrations in Area 3 are less than 1000 ppm. Cover failure, therefore, would not cause significant short term impact to human health and the environment.

Monitoring and access restrictions required by Alternative C are implementable. Cap and cover inspections could be conducted with little or no difficulty. The deed restrictions and restrictive covenants required are also implementable, but possibly not immediately so, due to the careful legal review required.

4.4.7 Cost

Alternative C is moderately costly. Total capital costs are estimated at $5,928,370. Total annual operating costs are estimated at $35,300 (no adjustment for inflation). Total present worth for 30 years operation assuming 5% interest is estimated at $6,471,000. A detailed cost estimate for Alternative C is presented on Table 16.

4.5 Alternative D

Under Alternative D, containerzied drosses would be removed from the Taracorp Pile and recycled at a secondary smelter. Wastes contained in the Taracorp Pile would be capped in place using a multimedia cap. Contaminated materials at Eagle Park Acres and Venice Alleys, and contaminated soils at Areas 1, 2, and 3, would be excavated and consolidated into the Taracorp pile prior to multimedia capping.

4.5.1 Protection of Human Health and the Environment

Alternative D is evaluated as being protective of human health and the environment, as it would eliminate the potential for direct contact with contaminants, and would eliminate contaminant migration (via ground water, surface water, or air pathway).

4.5.2 Compliance with ARARs

Chemical Specific ARARs

The following chemical specific ARARs would apply to Alternative D:

> PCBRR's; Title 35; EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243: Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead. (Ambient Air Quality Standard for Lead = 1.5 ug/m^3)
>
> Occupational Safety and Health Administration (OSHA) 29 CFR 1910. (Permissible Exposure Limit for Lead = 50 ug/m^3)
>
> PCBRR's; Title 35; EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 302: Water Quality Standards; Subpart B: General Use Water Quality Standards; Section 302.208: Chemical Constituents.

The remedial action required by Alternative D would comply with these ARARs. Dust control and monitoring would, however, be required at all excavations and material handling locations.

Action Specific ARARs

The following action specific ARAR would apply to Alternative D:

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201; Permits and General Provisions; Subpart C; Prohibitions; Section 201.141: Prohibition of Air Pollution.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 212; Visual and Particulate Matter Emissions; Subpart K: Fugitive Particulate Matter.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243; Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 721: Identification and Listing of Hazardous Wastes.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 723: Standards Applicable to Transporters of Hazardous Waste.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 725: Interim Status Standards for Owners and Operators of Hazardous Waste TSD Facilities; Subpart N: Landfills.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; and Chapter II: EPA; 35 IAC Part 809: Special Waste Hauling, Subparts B-G.

The Taracorp Pile multimedia cap could be constructed to meet the requirements of these ARARs. Remote area excavation and transportation of wastes and contaminated soils could also be conducted in accordance with these ARARs. Dust monitoring and control, however, would be required.

Location Specific ARARs

No location specific ARARs have been identified for Alternative D.

4.5.3 Long Term Effectiveness

The overall long term effectiveness of Alternative D is considered excellent.

Taracorp Pile

The remedial action prescribed by Alternative D at the Taracorp pile, including the SLLR piles and the contained drosses, is considered to be highly effective in the long term. The containerized drosses would be removed and recycled. Although the magnitude or toxicity of the slag and battery casings would not be reduced, the long term risks to human health and the environment would be greatly reduced by capping the piles in place. Capping is a proven method of long term containment of both municipal and industrial wastes. It would meet all remedial objectives, including eliminating the potential of direct contact with waste materials, eliminating the potential for migration of contaminated dust, and limiting the migration of metals to ground water. A computer model predicted a 99.99% reduction in percolation through the multimedia cap. Modeling results are shown in Appendix A.

Long term management of the cap would be required to insure adequate performance. Such management would include regular mowing, as well as reseeding and fertilization when required. If the vegetative cover were not properly maintained, cap repair (soil augmentation) could be required. Required monitoring would include semiannual ground water monitoring and semiannual air sampling. A quarterly cap inspection would also be required. No difficulties would be expected to be encountered implementing maintenance or monitoring requirements.

If properly constructed and maintained, the likelihood that the in-situ cap will require replacement is minimal. As the Taracorp piles have been in place for some time, settling, with the subsequent detrimental effects to cap integrity, would not be expected. In the unlikely event of cap failure, however, institutional controls would remain in place to guard against direct contact, and repair or replacement could be effected promptly to minimize serious dust generation or ground water contamination. The magnitude of such impact would also be minimized by the industrial location of the site.

Remote Areas

The remedial actions prescribed for Venice Alleys, Eagle Park Acres, and Areas 1, 2, and 3 are evaluated as being excellent in long term effectiveness, as contaminated soils and materials would be removed. The removal prescribed would eliminate the necessity for long term monitoring or maintenance in these areas.

4.5.4 Reduction of Toxicity, Mobility, or Volume

Implementation of Alternative D requires the removal and recycling of contained drosses at the Taracorp Pile. The toxicity and volume of these drosses, therefore, would be eliminated.

At the Taracorp pile, in-situ containment would significantly reduce the mobility of contaminants, because the installation of a multimedia cap would eliminate run-on and direct contact of precipitation with the waste materials, and waste materials would not be subject to wind scour. The high alkalinity of the ground water, the low solubility of metal carbonates, and cation exchange within the unconsolidated deposits would also function to limit contaminant mobility.

Contaminant mobility would be eliminated at Eagle Park, Venice Alleys, and Areas 1, 2, and 3, since contaminants in these areas would be removed.

4.5.5 Short Term Effectiveness

Alternative D requires the excavation of contaminated materials and soils from Eagle Park Acres, Venice Alleys, and Areas 1, 2, and 3. Such excavation would create the risk of potential short term impact to human health and the environment by potentially generating contaminated dust. Dust monitoring and control therefore, would be required at all excavations and during consolidation, grading, and capping operations at Taracorp pile. A health and safety plan would address dust monitoring and control requirements, as well as worker and public safety concerns related to the construction activities required to implement the alternative.

The institutional controls and monitoring required by this alternative could be implemented in a relatively short period of time. Consolidation and capping activities at the Taracorp pile could be expected to take six to twelve months; excavation and restoration activities at Venice Alleys two to four months; Eagle Park Acres one to three months; Area 1 two to four months; Areas 2 and 3 eight to twelve months each. Actual remediation times would depend largely on the degree of mobilization. Although many of the above activities could be conducted concurrently, most activities would be restricted to the spring, summer, and autumn. Alternative D therefore, would be expected to require one to two years to complete. This time estimate does not include time required to prepare plans and specifications or obtain necessary construction permits.

4.5.6 Implementability

With the exception of contained drosses on the the Taracorp Pile, Alternative D can be implemented entirely using standard construction techniques. Given the size of the metropolitan St. Louis area, mobilizing suitable construction equipment and operators would not be anticipated to be difficult. Heavy equipment would be required to consolidate the SLLR piles with the Taracorp pile; dust monitoring and control measures would be also implemented. Multimedia caps are also installed using standard construction techniques, although care must be given to the installation of the synthetic membrane. Heavy equipment, light equipment, and manual labor would be required to excavate and restore Eagle Park Acres, Venice Alleys, and Areas 1, 2, and 3. Dust monitoring and control measures would be required. It should be noted that work in Area 2 and 3 could be slow due to their confined nature and the requirement to relocate incidentals (both public and private facilities, fixtures, and small structures).

The contained lead drosses would be removed from the pile and shipped to a secondary lead smelter. At least one smelter has shown some interest in these materials (D. Mickey, 1989). If, however, a smelter could not be found to accept the materials, they would be included within the Taracorp pile multimedia cap.

Additional remedial actions would not be anticipated should Alternative D be implemented.

Monitoring and access restrictions required by Alternative D are implementable. Cap inspections could be conducted with little or no difficulty. The deed restrictions and restrictive covenants required are also implementable, but possibly not immediately so, due to the careful legal review required.

4.5.7 Cost

Alternative D is moderately costly. Total capital costs are estimated at $6,292,820. Total annual operating costs are estimated at $35,300 (no adjustment for inflation). Total present worth for 30 years operation assuming 5% interest is estimated at $6,835,450. A detailed cost estimate for Alternative D is presented on Table 17.

4.6 Alternative E

Under Alternative E, containerized drosses would be removed from the Taracorp Pile and recycled at a secondary smelter. Wastes contained in the Taracorp Pile would be excavated and moved to a lined disposal area adjacent to the current waste pile. The waste materials would then be capped using a multimedia cap. Contaminated materials at Eagle Park Acres and Venice Alleys, and contaminated soils at Areas 1, 2, and 3 would be excavated and transported to the lined disposal area prior to multimedia capping.

4.6.1 Protection of Human Health and the Environment

Alternative E is evaluated as being protective of human health and the environment, as it would eliminate the potential for direct contact with contaminants, and would eliminate contaminant migration (via ground water, surface water, or air pathway).

4.6.2 Compliance with ARARs

Chemical Specific ARARs

The following chemical specific ARARs would apply to Alternative E:

PCBRR's; Title 35; EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243: Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead. (Ambient Air Quality Standard for Lead = 1.5 ug/m^3)

Occupational Safety and Health Administration (OSHA) 29 CFR 1910. (Permissible Exposure Limit for Lead = 50 ug/m^3)

PCBRR's; Title 35; EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 302: Water Quality Standards; Subpart B: General Use Water Quality Standards; Section 302.208: Chemical Constituents.

The remedial action required by Alternative E would comply with these ARARs. Dust control and monitoring would, however, be required at all excavations and material handling locations.

Action Specific ARARs

The following action specific ARARs would apply to Alternative E:

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201; Permits and General Provisions; Subpart C; Prohibitions; Section 201.141: Prohibition of Air Pollution.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 212; Visual and Particulate Matter Emissions; Subpart K: Fugitive Particulate Matter.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243; Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 304: Effluent Standards; Subpart A: General Effluent Standards.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 307: Sewer Discharge Criteria; Subpart B: General and Specific Pretreatment Requirements.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 310: Pretreatment Programs; Subpart B: Pretreatment Standards; and Subpart D: Pretreatment Permits.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 312: Treatment Plant Operator Certification.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 370: Recommended Standards for Sewer Works.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 721: Identification and Listing of Hazardous Wastes.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 723: Standards Applicable to Transporters of Hazardous Waste.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 725: Interim Status Standards for Owners and Operators of Hazardous Waste TSD Facilities; Subpart N: Landfills.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; and Chapter II: EPA; 35 IAC Part 809: Special Waste Hauling, Subparts B-G.

The Taracorp Pile multimedia cap, supplemental bottom liner, and leachate collection system could be constructed to meet the requirements of these ARARs. Remote area excavation and transportation of wastes and contaminated soils could also be conducted in accordance with these ARARs.

Location Specific ARARs

No location specific ARARs have been identified for Alternative E.

4.6.3 Long Term Effectiveness

The overall long term effectiveness of Alternative E is considered excellent.

Taracorp Piles

The remedial action prescribed by Alternative E at the Taracorp pile, including the SLLR piles and the contained drosses, is considered to be highly effective in the long term. The containerized drosses would be removed and recycled. Although the magnitude or toxicity of the slag and battery casings would not be reduced, the long term risks to human health and the environment would be greatly reduced by the containment specified by the alternative. Containment using a multimedia cap is a proven method of long term containment of both municipal and industrial wastes. It would meet all remedial objectives, including eliminating the potential of direct contact with waste materials, eliminating the potential for migration of contaminated dust, and limiting migration of metals to ground water. A computer model predicted a 99.99% reduction in percolation through the multimedia cap.

Modeling results are shown in Appendix A. The supplemental bottom liner would eliminate the potential for contaminant migration to groundwater in the unlikely event of cap failure.

Long term management of the cap would be required to insure adequate performance. Such management would include regular mowing, as well as reseeding and fertilization when required. If the vegetative cover were not properly maintained, cap repair (soil augmentation) could be required. Required monitoring would include semiannual ground water monitoring and semiannual air sampling. A quarterly cap inspection would also be required. No difficulties would be expected to be encountered implementing maintenance or monitoring requirements.

Although percolation through the multimedia cap would be expected to be minimal, installation of a bottom liner would require a leachate collection system to prevent potential build-up of liquid beneath the cap in the unlikely event of cap failure. This system would require maintenance and proper operation, if and when necessary.

If properly constructed and maintained, the likelihood that the multi-media cap or the supplemental bottom liner would require replacement is minimal. Proper placement and compaction of waste materials and contaminated soils, however, would be required to limit cap settling. In the unlikely event of cap failure, institutional controls would remain in place to guard against direct contact, and repair or replacement could be effected promptly to minimize dust generation or ground water contamination. The magnitude of such impact would also be minimized by the industrial location of the site.

Remote Areas

The remedial actions prescribed for Venice Alleys, Eagle Park, and Areas 1, 2, and 3 are evaluated as being excellent in long term effectiveness, as contaminated soils and materials would be removed. The removal prescribed would eliminate the necessity for long term monitoring or maintenance in these areas.

4.6.4 Reduction of Toxicity, Mobility, or Volume

Implementation of Alternative E requires the removal and recycling of contained drosses at the Taracorp Pile. The toxicity and volume of these drosses, therefore, would be eliminated.

At the Taracorp pile, containment utilizing a multimedia cap and supplemental bottom liner would significantly reduce the mobility of contaminants, because the installation of a multimedia cap would eliminate run-on and direct contact of precipitation with the waste materials, and waste materials would not be subject to wind scour. In the unlikely event of cap failure, the bottom liner would eliminate the possible flow of leachate to groundwater. The high alkalinity of the ground water, the low solubility of metal carbonates, and cation ion exchange within the unconsolidated deposits would also function to limit contaminant mobility.

Contaminant mobility would be eliminated at Eagle Park Acres, Venice Alleys, and Areas 1, 2, and 3, since contaminants in these areas would be removed.

4.6.5 Short Term Effectiveness

Alternative E requires the excavation of contaminated materials and soils from Eagle Park, Venice Alleys, and Areas 1, 2, and 3. Such excavation would create the risk of potential short term impact to human health and the environment by generating contaminated dust. Dust monitoring and control therefore, would be required at all remote location excavations. During the extensive excavation, consolidation, grading, and capping operations at Taracorp pile, significant quantities of highly contaminated dust could be generated. Dust monitoring and control would be critical. Air modeling conducted for another site involving battery case material (Dames & Moore, 1988) concluded that for alternatives involving large scale excavation of materials "substantial on-site controls would be necessary and there is a possibility that even maximal management controls on-site would not prevent excessive short-term off-site impacts". In addition, pile excavation and associated staging operations expose the waste materials to precipitation; appropriate runoff control measures would be required. A health and safety plan would address dust monitoring and control requirements, as well as worker and public safety concerns related to the construction activities required to implement the alternative.

The institutional controls and monitoring required by this alternative could be implemented in a relatively short period of time. Excavation, consolidation, and capping activities at the Taracorp pile could be expected to take twlve to eighteen months;

excavation and restoration activities at Venice Alleys two to four months, Eagle Park Acres one to three months; Area 1 two to four months, Areas 2 and 3 eight to twelve months each. Actual remediation times would depend largely on the degree of mobilization. Although many of the above activities could be conducted concurrently, most activities would be restricted to the spring, summer, and autumn. Alternative E therefore, would be expected to require three to four years to complete. This time estimate does not include time required to prepare plans and specifications or obtain necessary construction permits.

4.6.6 Implementability

With the exception of the contained drosses on the Taracorp Pile, Alternative E can be implemented entirely using standard construction techniques. Given the size of the metropolitan St. Louis area, mobilizing suitable construction equipment and operators would not be anticipated to be difficult. Heavy equipment would be required to excavate and move the Taracorp pile; dust monitoring and control measures would be critical during such extensive excavation. Multimedia caps and bottom liners are also installed using standard construction techniques, although care must be given to the installation of synthetic membranes. Heavy equipment, light equipment, and manual labor would be required to excavate and restore Eagle Park Acres, Venice Alleys, and Areas 1, 2, and 3. Dust monitoring and control measures would be required. It should be noted that work in Area 2 and 3 could be slow due to their confined nature and the requirement to relocate incidentals (both public and private facilities, fixtures, and small structures).

The contained lead drosses would be removed from the pile and shipped to a secondary lead smelter. At least one smelter has shown some interest in these materials (D. Mickey, 1989). If, however, a smelter could not be found to accept the materials, they would be included within the Taracorp pile multimedia cap.

Additional remedial actions would not be anticipated should Alternative E be implemented.

Monitoring and access restrictions required by Alternative E are implementable. Cap inspections could be conducted with little or no difficulty. The deed restrictions and restrictive covenants required are also implementable, but possibly not immediately so, due to the careful legal review required.

4.6.7 Cost

Alternative E is highly costly. Total capital costs are estimated at $12,523,260. Total annual operating costs are estimated at $35,300 (no adjustment for inflation). Total present worth for 30 years operation assuming 5% interest is estimated at $13,065,890. A detailed cost estimate for Alternative E is presented on Table 18.

4.7 Alternative F

Under Alternative F, containerized drosses would be removed from the Taracorp Pile and recycled at a secondary smelter. Wastes contained in the Taracorp Pile would be excavated and visually segregated. Slag would be moved to a lined disposal area adjacent to the current waste pile. Waste materials containing significant quantities of battery case materials and smeltable lead would be processed on site to recover plastic and lead. Residuals (slag, rubber casing) would be transferred to the lined disposal area. Recovered products would be shipped off-site for further processing; waste materials would then be capped using a multimedia cap. Contaminated materials at Eagle Park Acres and Venice Alleys, and contaminated soils at Areas 1, 2, and 3 would be excavated and transported to the lined disposal area prior to multimedia capping.

4.7.1 Protection of Human Health and the Environment

If the technology required to implement Alternative F were better developed, Alternative F would be evaluated as being protective of human health and the environment. In the long term, it would eliminate the potential for direct contact with contaminants, and would eliminate contaminant migration (via ground water, surface water, or air pathway). However, as discussed below, the implementability of Alternative F is highly questioned. Moreover, significant manual handling of contaminated materials is required by this alternative. In addition, the lead content of recovered plastics may render them unsuitable as recyclable products, and could act as a route for direct contact with lead. Therefore, Alternative F is evaluated as being poorly protective of human health and the environment.

4.7.2 Compliance with ARARs

Chemical Specific ARARs

The following chemical specific ARARs would apply to Alternative F:

PCBRR's; Title 35; EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243: Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead. (Ambient Air Quality Standard for Lead = 1.5 ug/m^3)

Occupational Safety and Health Administration (OSHA) 29 CFR 1910. (Permissible Exposure Limit for Lead = 50 ug/m^3)

PCBRR's; Title 35; EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 302: Water Quality Standards; Subpart B: General Use Water Quality Standards; Section 302.208: Chemical Constituents.

PCBRR's; Title 35; EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 721: Identification and Listing of Hazardous Waste; Subpart C: Characteristics of Hazardous Waste; Section 721.124: Characteristics of EP Toxicity. (Extraction Potential Toxicity Lead 5.0 mg/l)

The remedial action required by Alternative F would comply with these ARARs. Dust control and monitoring would, however, be required at all excavations and material handling locations. Particular care would be required with respect to the manual segregation required by the alternative.

Action Specific ARARs

The following action specific ARARs would apply to Alternative F:

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201; Permits and General Provisions; Subpart C; Prohibitions; Section 201.141: Prohibition of Air Pollution.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201; Permits and General Provisions; Subpart D: Permit Applications and Review Process; Section 201.152: Contents of Application for Construction Permit.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201; Permits and General Provisions; Subpart D: Permit Applications and Review Process; Section 201.157: Contents of Application for Operating Permit.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 203; Major Stationary Sources Construction and Operation.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 212; Visual and Particulate Matter Emissions; Subpart K: Fugitive Particulate Matter.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 212; Visual and Particulate Matter Emissions; Subpart L: Particulate Matter Emissions from Process Emission Sources; Section 212.321: New Process Sources.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243; Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 304: Effluent Standards; Subpart A: General Effluent Standards.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 307: Sewer Discharge Criteria; Subpart B: General and Specific Pretreatment Requirements.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 310: Pretreatment Programs; Subpart B: Pretreatment Standards; and Subpart D: Pretreatment Permits.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 312: Treatment Plant Operator Certification.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 370: Recommended Standards for Sewer Works.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 721: Identification and Listing of Hazardous Wastes.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 722: Standards Applicable to Generators of Hazardous Waste; Subparts A-E.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 723: Standards Applicable to Transporters of Hazardous Waste.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 725: Interim Status Standards for Owners and Operators of Hazardous Waste TSD Facilities; Subpart N: Landfills.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; and Chapter II: EPA; 35 IAC Part 809: Special Waste Hauling, Subparts B-G.

The Taracorp Pile multimedia cap, supplemental bottom liner, and leachate collection and treatment system could be constructed to meet the requirements of these ARARs. Remote area excavation and transportation of wastes and contaminated soils could also be conducted in accordance with these ARARs. Taracorp pile segregation, recovery, and recycling would also be designed to meet the requirements of these ARARs.

Location Specific ARARs

No location specific ARARs have been identified for Alternative F.

4.7.3 Long Term Effectiveness

The overall long term effectiveness of Alternative F is considered excellent.

Taracorp Piles

The short term effectiveness of segregation, separation, recovery, and recycling is questionable. Under the best of conditions, volume reduction is expected to be less than 10%; meeting this expectation is doubtful. Further discussion is included in Sections 4.7.4 and 4.7.6.

The remedial action prescribed by Alternative F for the unrecovered residuals (slag, rubber casings, debris) at the Taracorp pile, is considered to be effective in the long term. Although the magnitude of these wastes or their toxicity would not be reduced significantly by recycling and recovery, the long term risks to human health and the environment posed by the unrecoverable residuals would be greatly reduced by the containment specified by the alternative.

Containment using a multimedia cap is a proven method of long term containment of both municipal and industrial wastes. It would meet all remedial objectives, including eliminating the potential of direct contact with waste materials, eliminating the potential for migration of contaminated dust, and limiting the migration of metals to ground water. A computer model predicted a 99.99% reduction in percolation through the multimedia cap. Modeling results are shown in Appendix A. The supplemental bottom liner would eliminate the potential for contaminant migration to groundwater in the unlikely event of cap failure.

Long term management of the cap would be required to insure adequate performance. Such management would include regular mowing, as well as reseeding and fertilization when required. If the vegetative cover were not properly maintained, cap repair (soil augmentation) could be required. Required monitoring would include semiannual ground water monitoring and semiannual air sampling. A quarterly cap inspection would also be required. No difficulties would be expected to be encountered implementing maintenance or monitoring requirements.

Although percolation through the multimedia cap would be expected to be minimal, installation of a bottom liner would require a leachate system to prevent potential build-up of liquids beneath the cap in the unlikely event of cap failure. This system would require maintenance and proper operation, if and when necessary.

If properly constructed and maintained, the likelihood that the multi-media cap or the supplemental bottom liner would require replacement is minimal. Proper placement and compaction of waste materials and contaminated soils, however, would be required to limit cap settling. In the unlikely event of cap failure, however, institutional controls would remain in place to guard against direct contact, and repair or replacement could be effected promptly to minimize dust generation or ground water contamination. The magnitude of such impact would also be minimized by the industrial location of the site.

Remote Areas

The remedial actions prescribed for Venice Alleys, Eagle Park Acres, and Areas 1, 2, and 3 are evaluated as being excellent in long term effectiveness, as all contaminated soils and materials would be removed. The removal prescribed would eliminate the necessity for long term monitoring or maintenance in these areas.

4.7.4 Reduction of Toxicity, Mobility, or Volume

Implementation of Alternative F requires the removal and recycling of containerized drosses at the Taracorp Pile. The toxicity and volume of these drosses, therefore, would be eliminated. The alternative does not, however, significantly reduce the toxicity or volume of contaminants. Overall volume reduction of contaminated materials is estimated to be less than 10%. In addition, the proposed hydroclassification equipment uses water to separate and slurry transfer materials. As the acid content of the materials would be expected to be significantly less than that of whole batteries, much of this water could be recycled after sedimentation in a clarifier to remove suspended solids. Periodically, however, a portion of the water would require treatment by precipitation, which would generate a sludge. Moreover, the plastics recovered would require rinsing and cleaning; rinse water treatment would also be expected to generate a sludge.

For residuals and unrecovered materials, containment utilizing a multimedia cap and supplemental bottom liner would significantly reduce the mobility of contaminants, because the installation of a multimedia cap would eliminate run-on and direct contact of precipitation with the waste materials, and waste materials would not be subject to wind scour. In the unlikely event of cap failure, the bottom liner would eliminate the possible flow of leachate to groundwater. The high alkalinity of the ground water, the low solubility of metal carbonates, and cation ion exchange within the unconsolidated deposits would also function to limit contaminant mobility.

Contaminant mobility would be eliminated at Eagle Park Acres, Venice Alleys, and Areas 1, 2, and 3, since contaminants in these areas would be removed.

4.7.5 Short Term Effectiveness

Alternative F requires the excavation of contaminated materials and soils from Eagle Park, Venice Alleys, and Areas 1, 2, and 3. Such excavation would create the risk of potential short term impact to human health and the environment by generating contaminated dust. Dust monitoring and control therefore, would be required at all remote location excavations. During the extensive excavation, consolidation, grading, and capping operations at Taracorp pile significant quantities of highly contaminated dust could be generated. Dust control would be critical. Air modeling conducted for another site involving battery case material (Dames & Moore, 1988) concluded that for alternatives involving large scale excavation of material "substantial on-site controls would be necessary and there is a possibility that even maximal management controls on-site would not prevent excessive short term off-site impacts". In addition, excavating the pile, and associated staging operations, expose the waste materials to precipitation; appropriate runoff control measurers would be required. A health and safety plan would address dust monitoring and control requirements, as well as worker and public safety concerns related to the construction activities required to implement the alternative.

The recovery utilized during the implementation of Alternative F would require significant manual segregation and handling of contaminated materials. Controls to protect workers from inadvertent ingestion and inhalation of lead, therefore, would have to be strictly adhered to. Adequate supervision of workers would be required.

The institutional controls and monitoring required by this alternative could be implemented in a relatively short period of time. Excavation, consolidation, and capping activities at the Taracorp pile could be expected to take twleve to eighteen months; segregation and recovery operations could be expected to take two or three years; excavation and restoration activities at Venice Alleys two to four months; Eagle Park Acres one to three months; Area 1 two to four months; Areas 2 and 3 eight to twelve months each. Actual remediation times would depend largely on the degree of mobilization. Although many of the above activities could be conducted concurrently, most construction related activities would be restricted to the spring, summer, and autumn. Alternative F therefore, would be expected to require five to six years to complete. This time estimate does not include time required to prepare plans and specifications or obtain necessary permits.

4.7.6 Implementability

Segregation, recovery, recycling

The implementability of the segregation, recycling, and recovery portion of Alternative F is highly questionable, and the subject of considerable study by others (Exhibit A).

Equipment

Equipment specifically designed to separate slag and other debris from battery casings (rubber and plastic), lead, and lead oxide is currently not commercially available. Therefore, equipment designed to break and separate the materials in whole batteries would be used to implement the alternative. The hydro-classification equipment proposed separates materials by differences in specific gravity. Inherent in this separation scheme is that dirt and slag in the equipment influent would be classified with lead and lead oxide. One source indicated that the "lead and lead oxide" recovered from the breaking of whole batteries (ideal conditions) is generally only 50-60% lead. Efficient removal of slag, dirt, and other contaminants, therefore, would be essential in recovering a material with sufficient lead content to be acceptable to secondary lead smelters. Light contaminants, such as wood, would be classified with plastics. Plastics manufactures are generally intolerable of contaminants, as contaminants foul intrusion injectors. Slag, dirt, and other debris, therefore, would have to be hand picked from influent conveyor. In addition, the proposed hydroclassification equipment is designed to break and handle materials with a hardness comparable to that of lead. Pieces of blast furnace slag greater than 1 inch long in any dimension, would severely damage the equipment. Screening devices could be used to protect the equipment, however, these devices would also screen out large pieces of recoverable plastic casing.

Recycling of Recovered Material

As previously discussed, the lead content of the recovered lead oxide/metallic lead/slag and dirt mixture may not be high enough to be acceptable to secondary lead smelters. A minimum lead content of 27% is often considered a minimum cutoff. The ability of the segregation/separation system to achieve such a high lead content is unlikely.

In addition to the requirement that recovered plastics be relatively free of solid contaminants, which interfere with intrusion processes, recovered plastics must also contain an acceptable content of lead. In a Feasibility Study conducted on another site involving battery case material (Dames & Moore, 1988), it was determined through field testing that

- recovered plastic failed the TCLP lead test;
- a deionized water wash has no or little effect on the lead content; and
- a hydrochloric acid wash removes only a minor fraction of the lead.

The evaluation concluded that the lead appeared to be interstitial and/or bound into the solid matrix of the plastic. Given the growing availability of plastic (uncontaminated) for recycling (Basta and Johnson, 1989), the likelihood that plastics manufacturers would accept the recovered plastic is uncertain, even if some method is developed to render it non-toxic.

Containment of contaminated soils and residuals

The excavation, transport, consolidation, and containment tasks required by Alternative F can be implemented entirely using standard construction techniques. Given the size of the metropolitan St. Louis area, mobilizing suitable construction equipment and operators would not be anticipated to be difficult. Heavy equipment would be required to excavate and move the Taracorp pile; dust monitoring and control measures would be critical during such extensive excavation. Multimedia caps and bottom liners are also installed using standard construction techniques, although care must be given to the installation of synthetic membranes. Heavy equipment, light equipment, and manual labor would be required to excavate and restore Eagle Park, Venice Alleys, and Areas 1, 2, and 3. Dust monitoring and control measures would be required. It should be noted that work in Area 2 and 3 could be slow due to their confined nature and the requirement to relocate incidentals (both public and private).

The contained lead drosses would be removed from the pile and shipped to a secondary lead smelter. At least one smelter has shown some interest in these materials. If, however, a smelter could not be found to accept the materials, they would be included within the Taracorp pile multimedia cap.

Additional remedial actions would not be anticipated should Alternative F be implemented.

Monitoring and access restrictions required by Alternative F are implementable. The deed restrictions and restrictive covenants required are also implementable, but possibly not immediately so, due to the careful legal review required.

4.7.7 Cost

Alternative F is highly costly. Total capital costs are estimated at $26,791,300. Total annual operating costs are estimated at $35,300 (no adjustment for inflation). Total present worth for 30 years operation assuming 5% interest is estimated at $27,333,930. A detailed cost estimate for Alternative F is presented on Table 19.

4.8 Alternative G

Under Alternative G, containerized drosses would be removed from the Taracorp Pile and recycled at a secondary smelter. Wastes contained in the Taracorp Pile would be excavated and visually segregated. Slag would be transported to a RCRA landfill. Waste materials containing significant quantities of battery case materials and smeltable lead would be processed on site to recover plastic and lead. Residuals (slag, rubber casing) would be transferred to the lined disposal area. Recovered products would be shipped off-site for further processing; waste materials would then be capped using a multimedia cap. Contaminated materials at Eagle Park Acres and Venice Alleys, and contaminated soils at Areas

1 and 2 would be excavated and transported to a RCRA landfill. Contaminated soils from Area 3 would be excavated and transported to a non RCRA landfill.

4.8.1 Protection of Human Health and the Environment

If the technology required to implement the recovery and recycling portion of Alternative G were better developed, Alternative G would be evaluated as being protective of human health and the environment. In the long term, it would eliminate the potential for direct contact with contaminants, and would eliminate contaminant migration (via ground water, surface water, or air pathway). However, as discussed below, the implementability of Alternative G is highly questioned. Moreover, significant manual handling of contaminated materials is required by this alternative. In addition, the lead content of recovered plastics may render them unsuitable as recyclable products, and could act as a route for direct contact with lead. Therefore, Alternative G is evaluated as being poorly protective of human health and the environment.

4.8.2 Compliance with ARARs

Chemical Specific ARARs

The following chemical specific ARARs would apply to Alternative G:

PCBRR's; Title 35; EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243: Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead. (Ambient Air Quality Standard for Lead = 1.5 ug/m^3)

Occupational Safety and Health Administration (OSHA) 29 CFR 1910. (Permissible Exposure Limit for Lead = 50 ug/m^3)

PCBRR's; Title 35; EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 302: Water Quality Standards; Subpart B: General Use Water Quality Standards; Section 302.208: Chemical Constituents.

PCBRR's; Title 35; EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 721: Identification and Listing of Hazardous Waste; Subpart C: Characteristics of Hazardous Waste; Section 721.124: Characteristics of EP Toxicity. (Extraction Potential Toxicity Lead 5.0 mg/l)

The remedial action required by Alternative G would comply with these ARARs. Dust control and monitoring would, however, be required at all excavations and material handling locations.

Particular care would be required with respect to the manual segregation required by the alternative.

Action Specific ARARs

The following action specific ARARs would apply to Alternative G:

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201; Permits and General Provisions; Subpart C; Prohibitions; Section 201.141: Prohibition of Air Pollution.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201; Permits and General Provisions; Subpart D: Permit Applications and Review Process; Section 201.152: Contents of Application for Construction Permit.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201; Permits and General Provisions; Subpart D: Permit Applications and Review Process; Section 201.157: Contents of Application for Operating Permit.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 203; Major Stationary Sources Construction and Operation.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 212; Visual and Particulate Matter Emissions; Subpart K: Fugitive Particulate Matter.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 212; Visual and Particulate Matter Emissions; Subpart L: Particulate Matter Emissions from Process Emission Sources; Section 212.321: New Process Sources.

PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243; Air Quality Standards and Episodes; Subpart B: Standards and Measurement Methods; Section 243.126: Lead.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 304: Effluent Standards; Subpart A: General Effluent Standards.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 307: Sewer Discharge Criteria; Subpart B: General and Specific Pretreatment Requirements.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 310: Pretreatment Programs; Subpart B: Pretreatment Standards; and Subpart D: Pretreatment Permits.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 312: Treatment Plant Operator Certification.

PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 370: Recommended Standards for Sewer Works.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 721: Identification and Listing of Hazardous Wastes.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 722: Standards Applicable to Generators of Hazardous Waste; Subparts A-E.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 723: Standards Applicable to Transporters of Hazardous Waste.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 725: Interim Status Standards for Owners and Operators of Hazardous Waste TSD Facilities; Subpart N: Landfills.

PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; and Chapter II: EPA; 35 IAC Part 809: Special Waste Hauling, Subparts B-G.

The Taracorp Pile multimedia cap, supplemental bottom liner, and leachate collection and treatment system could be constructed to meet the requirements of these ARARs. Remote area excavation and transportation of wastes and contaminated soils could also be conducted in accordance with these ARARs. Taracorp pile segregation, recovery, and recycling would also be designed to meet the requirements of these ARARs.

Location Specific ARARs

No location specific ARARs have been identified for Alternative G.

4.8.3 Long Term Effectiveness

The overall long term effectiveness of Alternative G is considered excellent.

Taracorp Piles

The short term effectiveness of segregation, separation, recovery, and recycling is questionable. Under the best of conditions, volume reduction is expected to be less than 10%; meeting this expectation is doubtful. Further discussion is included in Sections 4.8.4 and 4.8.6.

The remedial action prescribed by Alternative G for the unrecovered residuals (slag, rubber casings, debris) Taracorp pile, is considered to be effective in the long term. Although the magnitude of these wastes or their toxicity is not reduced significantly by recycling and recovery, the long term risks to human health and the environment posed by the unrecoverable residuals is reduced by disposal in a RCRA landfill.

Disposal in a RCRA landfill is a much used method for containment of industrial wastes. It would meet all remedial objectives, including eliminating the potential of direct contact with waste materials, eliminating the potential for migration of contaminated dust, and eliminating the migration of metals to ground water.

Remote Areas

The remedial actions prescribed for Venice Alleys, Eagle Park, and Areas 1, 2, and 3 are evaluated as being excellent in long term effectiveness, as contaminated soils and materials would be removed. The removal prescribed would eliminate the necessity for long term monitoring or maintenance in these areas.

4.8.4 Reduction of Toxicity, Mobility, or Volume

Implementation of Alternative G requires the removal and recycling of contained drosses at the Taracorp Pile. The toxicity and volume of these drosses, therefore, would be eliminated. The atlernative does not, however, significantly reduce the toxicity or volume of contaminants. Overall volume reduction of contaminated materials is estimated to be less than 10%. In addition, the proposed hydroclassification equipment uses water to separate and slurry transfer materals. As the acid content of the materials would be expected to be significantly less than that of whole batteries, much of this water could be recycled after sedimentation in a clarifier to remove suspended solids. Periodically, however, a portion of the water would require treatment by precipitation, which would generate a sludge. Moreover, the plastics recovered would require rinsing and cleaning; rinse water treatment would also be expected to generate a sludge.

For residuals and unrecovered materials, disposal in a RCRA landfill would significantly reduce the mobility of contaminants. Contaminant mobility would be eliminated at Eagle Park, Venice Alleys, and Areas 1, 2, and 3, since contaminants in these areas would be removed.

4.8.5 Short Term Effectiveness

Alternative G requires the excavation of contaminated materials and soils from Eagle Park Acres, Venice Alleys, and Areas 1, 2, and 3. Such excavation would create the risk of potential short term impact to human health and the environment by generating contaminated dust. Dust monitoring and control therefore, would be required at all remote location excavations. A health and safety plan would address dust monitoring and control requirements, as well as worker and public safety concerns related to the construction activities required to implement the alternative.

The recovery utilized during the implementation of Alternative G would require significant manual segregation and handling of contaminated materials. Controls to protect workers from inadvertent ingestion and inhalation of lead, therefore, would have to be strictly adhered to. Air modeling conducted for another site involving battery case material (Dames & Moore, 1988) concluded that for alternatives involving large scale excavation of materials "substantial on-site controls would be necessary and there is a possibility that even maximal management controls on-site would not prevent excessive short term off-site impacts". Adequate supervision of workers would be required.

The institutional controls and monitoring required by this alternative could be implemented in a relatively short period of time. Excavation and transportation activities at the Taracorp pile could be expected to take twelve to eighteen months; segregation and recovery operations could be expected to take to or three years; excavation and restoration activities at Venice Alleys two to four months; Eagle Park Acres one to three months; Area 1 two to four months; Areas 2 and 3 eight to twelve months each. Actual remediation times would depend largely on the degree of mobilization. Although many of the above activities could be conducted concurrently, most construction related activities would be restricted to the spring, summer, and autumn. Alternative G therefore, would be expected to require five to six years to complete. This time estimate does not include time required to prepare plans and specifications or obtain necessary permits.

4.8.6 Implementability

Segregation, Recovery, Recycling

The implementability of the segregation, recycling, and recovery portion of Alternative G is highly questionable and the subject of considerable study by others (Exhibit A).

Equipment

Equipment specifically designed to separate slag and other debris from battery casings (rubber and plastic), lead, and lead oxide is currently not commercially available. Therefore, equipment designed to break and separate the materials in whole batteries would be used to implement the alternative. The hydroclassification equipment proposed separates materials by differences in specific gravity. Inherent in this separation scheme is that dirt and slag in the equipment influent would be classified with lead and lead oxide. One source indicated that the "lead and lead oxide" recovered from the breaking of whole batteries (ideal conditions) is generally only 50-60% lead. Efficient removal of slag, dirt, and other contaminants, therefore, would be essential in recovering a material with sufficient lead content to be acceptable to secondary lead smelters. Light contaminants, such as wood, would be classified with plastics. Plastics manufactures are generally intolerable of contaminants, as contaminants foul intrusion injectors. Slag, dirt, and other debris, therefore, would have to be hand picked from influent conveyor. In addition, the proposed hydroclassification equipment is designed to break and handle materials with a hardness comparable to that of lead. Pieces of blast furnace slag greater than 1 inch long in any dimension, therefore would severely damage the equipment. Screening devices could be used to protect the equipment, however, these devices would also screen out large pieces of recoverable plastic casing.

Recycling of Recovered Material

As previously discussed, the lead content of the recovered lead oxide/metallic lead/slag and dirt mixture may not be high enough to be acceptable to secondary lead smelters. A minimum lead content of 27% is often considered a minimum cutoff. The ability of the segregation/separation system to achieve such a high lead content is unlikely.

In addition to the requirement that recovered plastics be relatively free of solid contaminants, which interfere with intrusion processes, recovered plastics must also contain an acceptable content of lead.

In a Feasibility Study conducted on another site involving batter case material (Dames & Moore, 1988), it was determined through field testing that

- recovered plastic failed the TCLP lead test;
- a deionized water wash has no or little effect on the lead content; and
- a hydrochloric acid wash removes only a minor fraction of the lead.

The evaluation concluded that the lead appeared to be interstitial and/or bound into the solid matrix of the plastic. iiven the growing availability of plastic (uncontaminated) for ecycling (Basta and Johnson, 1989), the likelihood that plastics anufacturers would accept the recovered plastic is uncertain, even f some method is developed to render it non-toxic.

Containment of contaminated soils and residuals

The excavation, transport, consolidation, and containment isks required by Alternative G can be implemented entirely using andard construction techniques. Given the size of the tropolitan St. Louis area, mobilizing suitable construction uipment and operators would not be anticipated to be difficult.

Heavy equipment would be required to excavate and move the Taracorp pile; dust monitoring and control measures would be critical during such extensive excavation. Heavy equipment, light equipment, and manual labor would be required to excavate and restore Eagle Park, Venice Alleys, and Areas 1, 2, and 3. Both RCRA and non-RCRA landfills have been identified in Illinois with the capacity to accept the waste. Dust monitoring and control measures would be required. It should be noted that work in Area 2 and 3 could be slow due to their confined nature and the requirement to relocate incidentals (both public and private).

The contained lead drosses would be removed from the pile and shipped to a secondary lead smelter. At least on smelter has shown some interest in these materials. If, however, a smelter could not be found to accept the materials, they would be included within the Taracorp pile multimedia cap.

Additional remedial actions would not be anticipated should Alternative G be implemented.

Monitoring and access restrictions required by Alternative G are implementable. The deed restrictions and restrictive covenants required are also implementable, but possibly not immediately so, due to the careful legal review required.

4.8.7 Cost

Alternative G is very highly costly. Total capital costs are estimated at $50,353,680. Total annual operating costs are estimated at $5,300 (no adjustment for inflation). Total present worth for 30 years operation assuming 5% interest is estimated at

$50,435,150. A detailed cost estimate for Alternative G is presented on Table 20.

4.9 Comparison of Alternatives

Table 21 presents a criteria by criteria summary of evaluation comments for each alternative. A discussion comparing the alternatives follows.

4.9.1 Overall Protection of Human Health and the Environment

Each of the seven alternatives is evaluated as being protective of human health and the environment.

Taracorp Pile

Alternative A would utilize institutional controls to limit the risk of direct contact at the Taracorp Pile. Alternatives B, C, and D would utilize a multimedia cap to eliminate the risk of direct contact and limit contaminant migration. Percolation through the multimedia cap has been shown to be reduced by 99.99% (Appendix A). Alternatives E and F would utilize a supplemental liner in addition to the multimedia cover. This liner would eliminate the potential for contaminant migration to groundwater in the unlikely event of cap failure. Alternative G would utilize a RCRA landfill to contain the waste materials. Each remedial alternative, therefore, would effectively protect human health and the environment.

Remote Areas

Alternative B would utilize sod or asphalt as a cover to reduce the risk of direct contact and contaminant migration in the remote areas. Alternative C would utilize excavation and restoration in all remote areas, with the exception of Area 3, where lead concentrations are substantially lower than other remote areas. Alternatives D, E, F, and G would utilize excavation and restoration in the remote areas to eliminate the risk of direct contact or contaminant migration. Upon completion of remedial action, therefore, each remedial alternative would effectively protect human health and the environment.

4.9.2 Compliance with ARARs

ARARs would not be met for Alternative A, however, Alternatives B, C, and D are expected to meet ARARs. Alternatives E, F, and G may have difficulty meeting air ARARs during bulk excavation.

4.9.3 Long Term Effectiveness

The No Action Alternative would reduce the risk of human exposure by direct contact at the Taracorp Pile, Eagle Park, and Area 1. The risk of airborne migration of contaminants, however, would remain at all areas. It should be noted the Health Risk Assessment in the RI indicated that no unacceptable risks to human health exist in any area.

The cover provided by Alternative B in the remote Areas would eliminate the risk of human exposure upon completion of remediation, however, this risk elimination can not be insured over time due to maintenance requirements and the potential for uncontrolled excavation. The excavation and restoration of the remote areas prescribed by Alternatives D, E, F, and G would permanently eliminate the risk of human exposure in all remote areas. Alternative C prescribes cover for Area 3, and excavation and restoration for the remaining areas. As lead soil concentrations in Area 3 are below 1000 ppm, cover is evaluated as providing permanent protection in this area.

The multimedia cap used in Alternatives B, C, and D would be effective in achieving all remedial objectives, including eliminating the risk of human exposure, and preventing the migration of contaminants via the air or groundwater pathway. The supplemental bottom liner prescribed by Alternatives E and F would provide an additional level of protection in preventing migration of contaminants to groundwater; however, this additional level of protection would increase the time required to effect remediation by 100%. The excavation required to install the supplemental liner would also increase the risk of airborne migration of contaminants, and expose the wastes to precipitation, increasing the risk of migration by surface runoff. The marginal increase in protection provided by the liner, therefore, does not appear to be justified.

Alternative G utilizes a RCRA landfill for containment of waste materials. Although wastes would be effectively contained, the cost of remediation would be a full order of magnitude higher than Alternatives B, C, and D, and four times higher than Alternative E. Alternative G, therefore does not appear to be justified.

4.9.4 Reduction of Toxicity, Mobility, or Volume

Taracorp Pile

Alternatives B, C, D, E, F, and G would reduce contaminant volume and toxicity by recovering contained drosses and dusts at the Taracorp Pile.

Implementation of Alternatives F and G would require the segregation and recovery of recyclable plastics and smeltable lead from the Taracorp Pile. Such recovery, however, would reduce total contaminant volume by less than 10%. In addition, the recovered plastic would not be expected to pass the TCLP test for lead.

4.9.5 Short Term Effectiveness

Implementation of Alternatives A and B would produce minimal short term impact to community, workers, or the environment, as contaminated materials would be left in place. Implementation of Alternatives C, D, E, F, and G could generate dust in residential and commercial areas, which would require monitoring and control. Alternatives E, F, and G include significant excavation at the Taracorp Pile; the generated dust could impact the community, workers, and the environment. Unproven control measures would be required. Alternatives F and G also include extensive handling of waste materials at the Taracorp pile; worker health and safety could be jeopardized.

The following periods of time are required by each alternative to achieve protection of human health and the environment:

Alternative	Time
A	6-12 months
B,C,D	1-2 years
E	3-4 years
F,G	5-6 years

4.9.6 Implementability

Alternatives A, B, C, and D would utilize standard monitoring and construction techniques which would be readily implementable. The excavation of the Taracorp Pile incorporated in Alternatives E, F, and G would require dust control measures which are unproven for this type of situation. The segregation and recovery utilized by Alternatives F and G, however, would utilize equipment designed to handle batteries, not the slag and waste materials present at the Taracorp pile. In addition, the recovered products may not be suitable for recycling: the recovered plastic would not be expected to pass the TCLP test for lead, and the lead content of the recovered slag/dirt/lead mixture may not contain a high enough lead content to be acceptable to a secondary smelter. Evaluation of extensive field testing conducted for a similar superfund site (Dames & Moore, 1988) concluded "Based on the technical infeasibility of the recycling equipment to produce significant quantities of useful product, coupled with the inability to market resultant waste streams, the conclusion is clear that such recycling efforts are without significant benefit to the environment."

4.9.7 Cost

The costs of each alternative are presented below:

Alternative	Capital Cost	O&M	Present Worth
A	$143,840	$21,550	$475,110
B	$5,142,390	$35,300	$5,685,020
C	$5,928,370	$35,300	$6,471,000
D	$6,292,820	$35,300	$6,835,450
E	$12,523,260	$35,300	$13,065,890
F	$26,791,300	$35,300	$27,333,930
G	$50,353,680	$5,300	$50,435,150

4.9.8 Summary

Each of the seven alternatives is evaluated as being protective of human health and the environment. Each action alternative would comply with ARARs.

With respect to the Taracorp Pile, the multimedia capping prescribed by Alternatives B, C, and D would be implementable and effective both long and short term. Direct contact and air emissions would be eliminated and percolation through the cap would be reduced from an estimated 253,556 cubic feet per year to 2 cubic feet per year. Implementation of Alternatives E, F, and G would be expected to cause short term health risks due to large scale excavation and dust generation (E, F, and G) and significant material handling (F and G). The necessity of the supplemental liner included in Alternatives E and F is questioned, as percolation will be reduced 99.99% by the proposed cover and evidence of heavy metal migration off-site with no controls is absent. The implementability of the segregation and subsequent recycling required by Alternatives F and G is highly questioned; in addition, volume reduction would be expected to be minimal.

With respect to the remote areas, the actions required by all alternatives are implementable, short term effective, and cost effective. Long term effectiveness cannot be insured by the cover required by Alternative B due to maintenance requirements and the numerous locations addressed. The excavation and removal required by Alternatives C, D, E, F, and G are all equally effective in the long term.

Alternatives which include the excavation and processing of the bulk materials in the Taracorp Pile will result in the atmospheric release of lead dust, generation of lead contaminated wastewater which will have to be managed, and an insignificant change in mobility and toxicity for the materials which remain after processing. Although these alternatives meet the ARARs, these alternatives do not meet the intent of SARA and are not considered acceptable remedial alternatives.

The evaluation of alternatives concluded that Alternative C satisfied the requirements for a remedy as defined in SARA. This alternative involves the excavation of soils from residential and commercial areas around the site, with restoration of these areas. It includes the excavation of remote areas where case material was deposited in the past, with restoration. In addition, this alternative includes the recycle and reuse of contained drosses and dusts present within the Taracorp Pile. Finally all excavated soils and case material would be consolidated in the existing 260,000 ton Taracorp Pile and covered with a multimedia cover. The cover would consist of a two foot thick 10-7 cm/sec clay barrier overlain by a synthetic membrane and necessary drainage layers. The consolidation of the contaminated soil and wastes in a single cell which is underlain by clay-like soils with 10^{-7} to 10^{-8} cm/sec permeability and overlain by multimedia impermeable cover, is an environmentally acceptable remedial program for this site.

Respectfully Submitted,

O'Brien & Gere Engineers, Inc.

Steven R. Garver, P.E.
Vice President

Prepared by:

Miriam Blumberg - Project Engineer - M.S. Environmental Engineering
Douglas Crawford - Senior Project Engineer - M.S. Civil Engineering
Frank Hale - Managing Engineer - M.S. Sanitary Science
James O'Loughlin - Design Engineer - B.S. Chemical Engineering

REFERENCES

Basta, N, and E. Johnson, 1989: Plastics Recycling Picks Up Momentum, Chemical Engineering, McGraw-Hill, July 1989.

Center for Disease Control, 1985: Preventing Lead Poisoning in Young Children, from USEPA Region 5 letter dated 7 September 1988 (Brad Bradley).

Dames and Moore, 1988: Feasibility Study Gould, Inc. Site, Portland, Oregon, Dames and Moore, Seattle, Washington, 1988.

Mickey, D, 1989: Personal communication with Doug Mickey of Master Metals, Cleveland, OH on 26 July 1989.

U.S. Environmental Protection Agency, 1988: CERCLA Compliance with Other Laws Manual, U.S. Environmental Protection Agency, (Draft, August 1988).

U.S. Environmental Protection Agency, 1988 (b): Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, U.S. Environmental Protection Agency, (Interim Final, August, 1988).

U.S. Environmental Protection Agency, 1988 (c): Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, U.S. Environmental Protection Agency, (Interim Final, October, 1988), EPA 540/G-89/004.

Tables

TABLE I

NL INDUSTRIES
GRANITE CITY
GROUND WATER DATA SUMMARY

SHALLOW WELLS[(2)]

parameter	101 avg.	101 max.	102 avg.	102 max.	103 avg.	103 max.	104 avg.	104 max.	105 avg.	105 max.	106 avg.	106 max.	107 avg.	107 max.	108 avg.	108 max.
Sulfate	168	190	165	210	190	210	125	130	-	320	-	290	280	300	-	1250
Total Dissolved Solids	615	690	625	640	525	550	380	400	-	1000	-	1100	835	850	-	3110
Lead[(1)]	.004*	.009	.008*	.012	LT.005	LT.005	LT.005	LT.005	-	LT.005	LT.005	LT.005	LT.005	LT.005	-	.005
Barium[(1)]	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1	-	LT 1	-	LT 1	LT 1	LT 1	-	LT 1
Cadmium[(1)]	.002*	.007	LT.001	LT.001	.001*	.002	.001*	.002	-	.002	-	.013	.001*	.001	-	.209
Selenium[(1)]	LT.0035	LT.005	LT.0035	LT.005	.003*	.003	.003*	.003	-	LT.005	-	LT.005	LT.0035	LT.005	-	LT.005
Arsenic[(1)]	.079	.101	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	-	LT.005	-	LT.005	LT.005	LT.005	-	LT.005
Copper[(1)]	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01	-	LT.01	-	LT.01	LT.01	LT.01	-	LT.01
Iron[(1)]	21	22	.085*	.12	LT.1	LT.1	LT.1	LT.1	-	LT.1	-	LT.1	LT.1	LT.1	-	LT.1
Nickel[(1)]	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01	-	LT.01	-	LT.01	LT.01	LT.01	-	LT.01
Manganese[(1)]	4.7	5.5	.197	.27	.036*	.06	.028	.03	-	LT.025	-	.08	.105	.139	-	13.1
Silver[(1)]	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	-	LT.005	-	LT.005	LT.005	LT.005	-	LT.005
Zinc[(1)]	.039*	.10	LT.035	LT.05	LT.035	LT.05	LT.035	LT.05	-	LT.02	-	.27	LT.035	LT.05	-	.04
Chromium[(1)]	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	-	LT.005	-	LT.005	LT.005	LT.005	-	LT.005
Antimony[(1)]	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02	-	LT.02	-	LT.02	LT.02	LT.02	-	LT.02
Mercury[(1)]	LT.0005	LT.0005	LT.0005	LT.0005	LT.0005	LT.0005	LT.0005	LT.0005	-	LT.0005	-	LT.0005	LT.0005	LT.0005	-	LT.0005

(1) Filterable Values
(2) All data reported in units of mg/l
* Average values calculated using one-half of detection limit for less than detectable values.

TABLE 2

NL INDUSTRIES
GRANITE CITY
GROUND WATER DATA SUMMARY

DEEP WELLS[2]

parameter	105 avg.	105 max.	106 avg.	106 max.	107 avg.	107 max.	108 avg.	108 max.	109 avg.	109 max.	110 avg.	110 max.
Sulfate	160	180	210	260	507	550	1759	1825	74	78	288	294
Total Dissolved Solids	640	660	685	770	1290	1370	4315	4600	520	530	993	1000
Lead[1]	LT.005	LT.005	.012	.013	LT.005	LT.005	.007*	.009	LT.005	LT.005	LT.005	LT.005
Barium[1]	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1	LT 1
Cadmium[1]	.003*	.006	.005	.008	LT.001	LT.001	3.85*	6.9	LT.001	LT.001	.002*	.004
Selenium[1]	LT.035	LT.005	.0028*	.003	LT.0035	LT.005	LT.0035	LT.005	LT.002	LT.002	LT.002	LT.002
Arsenic[1]	-	LT.005	.0037*	.005	.0068*	.014	.006*	.007	.0037*	.006	LT.005	LT.005
Copper[1]	LT.01	LT.01	.0125*	.02	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01
Iron[1]	-	LT .1	LT .1	LT .1	6.7	8.1	LT .1	LT .1	.17*	.4	LT .1	LT .1
Nickel[1]	LT.01	LT.01	LT.01	LT.01	LT.01	LT.01	.74	.94	LT.01	LT.01	.013	.02
Manganese[1]	.237	.284	.184	.359	.40	.43	25.4	29.4	.163	.28	.99	1.0
Silver[1]	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.002	LT.005
Zinc[1]	.0275*	.03	.067	.09	LT.02	LT.05	42.3	44	LT.02	LT.02	.013*	.02
Chromium[1]	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005	LT.005
Antimony[1]	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02	LT.02
Mercury[1]	LT.0005	LT.0005	LT.0005	LT.0005	LT.0005	LT.0005	LT.0005	LT.0005	LT.0002	LT.0002	LT.0002	LT.0002

(1) Filterable Values
(2) All data reported in units of mg/l
* Average values calucated using one-half of detection limit for less than detectable values.

TABLE 3

AMBIENT AIR LEAD MONITORING DATA - QUARTERLY AVERAGES (ug/m^3)(1)

	IEPA Air Monitor Location				
Year/Quarter	15th & Madison	19th & Adams	Roosevelt & Rock Road	1735 Cleveland	2001 & 20th
1978 - 2	3.1	0.6	0.7	--	--
3	1.7	4.4	1.3	--	--
4	4.4	4.0	1.3	--	--
1979 - 1	2.6	1.0	1.3	--	--
2	3.2	0.9	1.2	--	--
3	2.0	1.1	1.3	--	--
4	3.0	2.6	1.2	--	--
1980 - 1	3.0	0.5	0.6	--	--
2	1.2	0.6	0.5	--	--
3	1.0	0.5	0.7	--	--
4	1.9	0.6	1.4	--	--
1981 - 1	2.1	0.5	0.5	--	--
2	1.0	1.6	0.9	--	--
3	1.8	0.5	1.1	--	--
4	7.3	0.5	0.9	--	--
1982 - 1	1.9	0.8	1.1	--	--
2	1.6	0.9	1.5	--	--
3	1.1	0.5	0.6	--	--
4	0.9	0.6	1.8	1.5	--
1983 - 1	1.1	0.5	0.4	1.0	--
2	0.4	0.3	0.3	0.7	--
3	0.68	0.37	0.36	0.76	--
4	0.76	0.51	0.67	0.62	--
1984 - 1	1.48	0.31	0.37	0.74	--
2	0.76	0.29	0.30	0.74	--
3	0.34	0.23	0.23	0.40	--
4	0.39	0.26	0.30	0.45	--
1985 - 1	0.59	0.13	0.14	0.25	0.23
2	0.42	0.26	0.20	0.44	0.28
3	0.23	0.17	0.21	0.33	0.20
4	0.27	0.18	0.17	0.28	0.20
1986 - 1	0.44	0.15	(2)	0.42	0.23
2	0.24	0.13	(2)	0.28	0.15
3	0.24	0.15	(2)	0.38	0.15
4	0.32	0.20	(2)	0.24	0.23

Notes:

(1) Data from Illinois Environmental Protection Agency
(2) Monitor discontinued

TABLE 4

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS *

CHEMICAL SPECIFIC ARARs

1. PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 243: Air Quality Standards; Subpart B: Standards and Measurement Methods; Section 243.126: (Ambient Air Quality Standards = 1.5 $\mu g/m^3$)

2. Occupational Safety and Health Administration (OSHA) 29 CFR 1910 (Permissable Exposure Limits for Lead = 50 $\mu g/m^3$)

3. PCBRR's; Title 35: EP; Subtitle C; WP; Chapter 1: PCB; 35 IAC Part 302.208: Water Quality Standards; Subpart B: General Use Water Quality Standards (See Table 5).

4. PCBRR's; Title 35: EP; Subtitle G; WD; Chapter 1: PCB; 35 IAC Part 721.124: Identification and Listing of Hazardous Waste (Extraction Potential Toxicity Lead 5.0 mg/l)

ACTION SPECIFIC ARARs

1. Pollution Control Board Rules and Regulations (PCBRR's); Title 35: Environmental Protection (EP); Subtitle B; Air Pollution (AP); Chapter 1: Pollution Control Board (PCB); 35 Ill. Adm. Code (IAC) Part 201; Permits and General Provisions; Subpart C; Prohibitions; Section 201.141: Prohibition of Air Pollution.

2. PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201: Permits and General Provisions; Subpart D: Permit Applications and Review Process; Section 201.152: Construction Permit Application.

3. PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 201: Permits and General Provisions; Subpart D: Permit Applications and Review Process; Section 201.157: Operating Permit Application

4. PCBRR's; Title 35: EP; Subtitle B: AP; Chapter 1: PCB; 35 IAC Part 203: Major Stationary Sources Construction and Modification.

5. PCBRR's; Title 35: EP; Subtitle B: AP; Chapter 1: PCB; 35 IAC Part 212: Visual and Particulate Matter Emissions; Subpart K: Fugitive Particulate Matter.

6. PCBRR's; Title 35: EP; Subtitle B; AP; Chapter 1: PCB; 35 IAC Part 212: Visual and Particulate Matter Emissions; Subpart L: Particulate Matter Emissions from Process Emission Sources; Section 212.321: New Process Sources.

7. PCBRR's; Title 35: EP; Subtitle B: AP; Chapter 1: PCB; 35 IAC Part 243: Air Quality Standards; Subpart B: Standards and Measurement Methods; Section 243.126: Lead.

8. PCBRR's; Title 35: EP; Subtitle C: Water Pollution (WP); Chapter 1: PCB; 35 IAC Part 302: Water Quality Standards; Subpart B: General Use Water Quality Standards and Subpart C: Public and Food Processing Water Supply Standards.

9. PCBBR's; Title 35: EP; Subtitle C: (WP); Chapter 1: PCB; 35 IAC Part 304: Effluent Standards; Subpart A: General Effluent Standards.

TABLE 4
(continued)

ACTION SPECIFIC ARARs

10. PCBRR's; Title 35: EP; Subtitle C: WP; Chapter 1: PCB; 35 IAC Part 307: Sewer Discharge Criteria; Subpart B: General and Specific Pretreatment Requirements.

11. PCBRR's; Title 35; EP; Subtitle C: WP; Chapter 1: PCB; 35 IAC Part 310: Pretreatment Programs; Subpart B: Pretreatment Standards and Subpart D.

12. PCBRR's; Title 35: EP; Subtitle C: WP; Chapter 1: PCB; 35 IAC Part 312: Treatment Plant Operator Certification.

13. PCBRR's; Title 35: EP; Subtitle C: WP; Chapter 2: PCB; 35 IAC Part 370: Recommended Standards for Sewer Works.

14. PCBRR's; Title 35: EP; Subtitle G: Waste Disposal (WD); Chapter 1: PCB and Chapter II: Environmental Protection Agency (EPA); 35 IAC.

15. PCBRR's; Title 35: Chapter 1: 35 IAC Part 721: ID and LIsting of Hazardous Waste.

16. PCBRR's; Title 35: Chapter 1: 35 IAC Part 722: Hazardous Waste Generator Standards; Subparts A-E.

17. PCBRR's; Title 35: Chapter 1: 35 IAC Part 723: Hazardous Waste Transporter Standards.

18. PCBRR's; Title 35: Chapter 1: 35 IAC Part 725: Interim Status Standards For Hazardous Waste TSD Facility Owners and Operators. Section 725.410 Closure and Post Closure.

19. PCBRR's; Title 35: EP; Subtitle G: WD; Chapter 1: PCB and Chapter II: EPA; 35 IAC Part 809: Special Waste Hauling, Subparts B-G.

20. Ill. Revised Statutes, Chapter 111 1/2, Paragraph 1039(h).

21. PCBRR's; Title 35: EP; Subtitle H: Noise; Chapter 1: PCB; 35 IAC Part 901: Sound Emission Stds. and Limitations.

LOCATION SPECIFIC ARARs

None.

* Based on the alternatives developed, the following potential Applicable or Relevant and Appropriate Requirements (ARARs) supplied by Illinois Environmental Protection Ageney are not considered ARARs at the Taracorp Site.

11. PCBRR's; Title 35: EP, Subtitle C: WP; Chapter 1: PCB; 35 IAC Part 309 Permits; Subpart A: NPDES Permits.

12. PCBRR's; Title 35: EP; Subtitle C: WP; Chapter 1: PCB; 35 IAC Part 309; Subpart A: NPDES Permits; Section 309.143 Effluent Limitations.

16. Ill. Revised Statues; Shapter 19; Paragraph 65(f): Floodplains Construction Permits.

17. PCBRR's; Titel 35: EP; Subtitle G: Waste Disposal (WDP; Chapter 1: PCB and Chapter II Environmental Protection Agency (EPA); 35 IAC Part 700, Part 703, Part 705, part 724, and Part 726.

TABLE 4
(continued)

18. PCBRR's; Title 35: EP; Subtitle G: WD; Chapter 1: PCB and Chapter II: EPA; 35 IAC Part 729: Landfills: Prohibited Haz. Wastes; Subpart C: Liquid Hazardous Waste.

19. PCBRR's; Title 35: EP; Subtitle G: WD; Chapter 1: PCB and Chapter II: EPA; 35 IAC Part 807: Solid Waste, Subparts C, E, and F.

20. PCBRR's; Title 35: EP; Subtitle G: WD; Chapter 1: PCB and Chapter II: EPA; 35 IAC Part 807: Solid Waste; Subpart B.

TABLE 5

GROUND WATER QUALITY STANDARDS[1]

Parameter	General Use Standards [2]	Public and Food Processing Standards[3]	Federal Drinking Water Standards[5]
Arsenic	1.0	0.05	0.05
Barium	5.0	1.0	1.0
Boron	1.0	1.0	--
Cadmium	0.05	0.010	0.010
Chloride	500	250	250 *
Chromium VI	0.05	0.05	0.05
Chromium III	1.0	1.0	--
Copper	0.02	0.02	0.01 *
Cyanide	0.025	0.025	--
Fluoride	1.4	1.4	4.0
Iron	1.0	1.0	0.3 *
Lead	0.1	0.05	0.05
Manganese	1.0	0.15	0.05 *
Mercury	0.0005	0.0005	0.002
Nickel	1.0	1.0	--
Nitrate	--	10.0	10.0
Oil	--	0.1	--
Pesticides	--	-- [4]	-- [4]
Phenols	0.1	0.001	--
Selenium	1.0	0.01	0.01
Silver	0.005	0.005	0.05
Sulfate	500	250	250 *
TDS	1000	500	500 *
Zinc	1.0	1.0	5.0 *

[1] Concentrations expressed in mg/l

[2] 35 Illinois Administrative Code Part 302.208. General Use Standards

[3] 35 Illinois Administrative Code Part 302.304. Public and Food Processing Standards

[4] A number of pesticides with different concentration limits

[5] 40 CFR 141, 143 Drinking Water Standards

* Secondary maximum containment level

TABLE 6

PRELIMINARY REMEDIAL ACTION OBJECTIVES
TECHNOLOGY TYPES AND PROCESS OPTIONS

Environmental Media	Remedial Action Objectives	General Response Actions	Remedial Technology Type	Process Options
Soil	Prevent ingestion/ direct contact with soil having lead in excess of acceptable risk concentrations in residential yards, schools, and parks	No action Institutional Actions	No Action Institutional Options Fencing Deed Restriction	
		Containment Actions	Containment Technologies Capping Dust Controls	Sod/Soil/Asphalt Dust Control Agents
	Prevent inhalation of lead concentrations above 1.5 ug/m^3	Removal Actions	Removal Technologies Excavation	Solids Excavation
		Treatment Actions	Treatment Technologies Fixation	Lopat Enterprises Envirosafe Chemfix
	Prevent migration of lead to the groundwater which would result in a concentration higher than 0.1 mg/l in accordance with 35 IAC Part 302 B			
Solid Waste	Achieve on acceptable level of risk from direct contact with the waste pile contents	No Action Institutional Actions	No Action Institutional Options Fencing Deed Restrictions	
	Prevent inhalation of lead at concentrations above 1.5 ug/m^3	Containment Actions	Containment Technologies Capping Vertical barriers Horizontal barriers	Membrane, Asphalt, Concrete, Vegetative Slurry wall, sheet piling Grout injection
		Removal Technologies	Excavation Drum Removal	Solids excavation Drum Removal
	Prevent migration of metals to the ground water which would result in concentrations higher than 35 IAC Part 302 B standards	Treatment Actions	Treatment Technologies Physical treatment Chemical treatment	Crushing, grinding Lopat, Chemfix
		Recycle Actions	Recycle Technologies	Electrowinning Master Metals ASARCO Extraction Smelting

TABLE 7

ESTIMATED SURFACE AREAS, VOLUMES AND MASSES

	Surface Area (SF)	Volume (CY)	Mass (Tons)
Taracorp Pile			
Slag/Matte	NA	47,000	200,000
Case Material	NA	34,000	30,000
Lead Dust	NA	4,000	30,000
Contained Drosses, etc.	NA	8	12
Area 1 Unpaved Area			
Case Material	NA	400	5,400
Surface Soil	340,000 (1)	3,100 (2)	5,000 (3)
Area 2 Unpaved			
Driveways	110,000 (1)	1,000 (2)	1,600 (3)
Open/Lawns	350,000 (1)	3,200 (2)	5,200 (3)
Area 3, 4, 5 Unpaved			
Driveways	370,000 (1)	3,400 (2)	5,500 (3)
Open/Lawns	730,000 (1)	6,800 (2)	11,000 (3)
Venice Alleys	72,000	670	1,100
Eagle Park Acres	20,000	2,700	4,400

(1) Based on May 1988 aerial photographs at 1"=100' scale.

(2) Assumes 3" deep excavation.

(3) Assume 120 lbs./cubic foot of soil.

TABLE 8

GENERAL RESPONSE ACTIONS [1]

General Response Action
No Action
Containment
Pumping
Collection
Diversion
Complete Removal
Partial Removal
On-Site Treatment
Off-Site Treatment
In-Situ Treatment
Storage
On-Site Disposal
Off-Site Disposal
Alternative Water Supply
Relocation

[1] From: U.S. EPA, 1985. Guidance on Feasibility Studies Under CERCLA. Prepared for Hazardous Waste Engineering Research Laboratory, Cincinnati, Ohio, and Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, Washington, D.C.

TABLE 9

Initial Screening of Technologies and
Process Options for Soils/Alleys

General Response:

Action-Soil/Alleys	Remedial Tech.	Process Option	Description	Screening Comments
No Action	None	Not Applicable	No Action	Req'd for consideration by NCP
Institutional Action	Access Restrictions	Fencing	Fence around properties	Potentially applicable
	Access Restrictions	Land Use Restrictions	Restricts land use	Potentially applicable
	Access Restrictions	Deed Restrictions	Restricts land use	Potentially applicable
Containment Action	Capping	Clay	Compacted clay with soil over areas of contamination	Potentially applicable
	Capping	Asphalt	Layer of asphalt over areas of contamination	Potentially applicable
	Capping	Sod	Layer of sod over areas of contamination	Potentially applicable
	Capping	Concrete	Concrete slab over areas of contamination	Potentially applicable
	Land Disposal	Landfill	Placement of contaminated soils in non-RCRA landfill	Potentially applicable
Removal Action	Excavation	Backhoe	Excavation using backhoe	Potentially applicable
	Excavation	Crane	Excavation using crane	Not feasible due to need for fine control of excavator
	Excavation	Front-end Loader	Excavation using front end loader	Potentially applicable
	Excavation	Scrapers	Excavation using scrapers	Not feasible due to need for fine control of excavator
	Excavation	Pumps	Excavation using pumps	Not effective to excavate soils/fill
	Excavation	Industrial Vacuums	Excavation using industrial vacuums	Not effective to excavate soils/fill
	Excavation	Drum Grapplers	Excavation using drum grapplers	Not effective to excavate soils/fill
	Excavation	Forklifts	Excavation using forklifts	Not effective to excavate soils/fill
Treatment Action	Solidification/ Stabilization/ Fixation	Chemfix/Lopat Enterprises/ Envirosafe	Proprietary Fixation process	Potentially applicable
	Chemical/Physical	Soil Washing/Leaching	Extracts contaminants from solids	Potentially applicable
	Chemical/Physical Treatment	In-situ precipitation immobilization	Immobilizes inorganics in place	Not effective in addressing direct contact exposure
	Recycle/Recovery	Asphalt manufacturer	Hard rubber recycle of of asphalt	Potentially applicable for hard rubber used as fill and paving

TABLE 10

Initial Screening of Technologies and Process Options for Waste Piles

General Response: Action-Waste Piles	Remedial Tech.	Process Option	Description	Screening Comments
No Action	None	Not Applicable	No Action	Req'd for consideration by NCP
Institutional Action	Access Restrictions	Fencing	Fence around properties	Potentially applicable
	Access Restrictions	Land Use Restrictions	Restrict land use	Potentially applicable
	Access Restrictions	Deed Restrictions	Restrict land use	Potentially applicable
	Monitoring	Ground Water Monitoring	Long-term ground water monitoring program	Potentially applicable
Containment Action	Capping	Clay	Compacted clay with soil over areas of contamination	Potentially applicable
	Capping	Asphalt	Layer of asphalt over areas of contamination	Potentially applicable
	Capping	Sod	Layer of sod over areas of contamination	Not in compliance with regulations for hazardous waste
	Capping	Multimedia Cap	Synthetic membrane with soil over areas of contamination	Potentially applicable
	Capping	Concrete	Concrete slabs over areas of contamination	Potentially applicable
	Land Disposal	Landfill	Placement of RCRA in landfill or non-RCRA waste in a non-RCRA landfill	Potentially applicable
Removal Action	Excavation	Backhoe	Excavation using backhoe	Potentially applicable
	Excavation	Crane	Excavation using crane	Potentially applicable
	Excavation	Front-end Loader	Excavation using front end loader	Potentially applicable
	Excavation	Scrapers	Excavation using scrapers	Not effective in excavating fill
	Excavation	Pumps	Excavation using pumps	Not effective in excavating fill
	Excavation	Industrial Vacuum	Excavation using industrial vacuum	Not effective in excavating fill
	Excavation	Drum Grapplers	Excavation using drum grapplers	Potentially applicable for drum removal
	Excavation	Forklift	Excavation using forklifts	Not effective in excavating fill/drums
Treatment Action	Recycle/Recovery	Segregation M A Industries/ Polycycle/Cal West	Segregation using hydro-classification	Potentially applicable
	Recycle/Recovery	Heavy media separation	Segregation using heavy separation	Not effective for smaller particles (< 0.5 mm)
		Electrowinning	Electrolytic extraction of metals	Not feasible
	Chemical/Physical treatment	Leaching	Chemical extraction of metals	Not feasible
		Asphalt manufacturer	Hard rubber recycle with asphalt	Potentially applicable
	Solidification/ Stabilization/ Fixation	Chemfix/Lopat Enterprises/ Envirosafe	Proprietary fixation processes	Not feasible
	Thermal treatment	In-Situ Vitrification	Vitrifies materials in place	Not feasible
	Thermal treatment	Master Metals	2° lead smelter	Potentially applicable

TABLE 11

Evaluation of Process Options - Soils/Alleys

General Response:

Action-Soil/Alleys	Remedial Tech.	Process Option	Effectiveness	Implementability	Cost
No action	None	Not applicable*	Does not achieve remedial action objectives	Not acceptable to agencies	None
Institutional Action	Access Restrictions	Fencing*	Useful in limiting access. Does not reduce contamination.	Conventional construction. Alone, not acceptable to agencies	Low capital, low O&M
	Access Restrictions	Land Use* Restrictions	Useful in limiting exposures. Does not reduce contamination.	Land use changes may be difficult to implement.	Potentially moderate capital, low O&M
	Access Restrictions	Deed Restrictions*	Effectiveness depends on continued future implementation. Does not reduce contamination.	Legal requirement	Low capital
Containment Action	Capping	Clay	Effective susceptible to cracking, requires O&M	Easily implemented, restrictions on future land use.	Low capital, low O&M
	Capping	Asphalt*	Effective susceptible to weathering, requires O&M	Easily implemented, restrictions on future land use.	Low capital, low O&M
	Capping	Sod*	Effective, requires O&M	Easily implemented, restrictions on future land use.	Low capital, low O&M
	Capping	Concrete	Effective, susceptible to weathering, cracking, requires O&M.	Easily implemented, restrictions on future land use.	Moderate capital, moderate O&
	Land Disposal	Landfill*	Effective	Easily implemented	Moderate capital
Removal Action	Excavation	Backhoe*	Effective and reliable	Easily implemented	Moderate capital
	Excavation	Front-end Loader*	Effective and reliable	Easily implemented	Moderate capital
Treatment Action	Solidification/ Stabilization/ Fixation	Chemfix, Lopat Enterprises Envirosafe	Effectiveness and reliability require pilot test to determine	Readily implemented	High capital
	Chemical/Physical Treatment	Soil Washing/ Leaching	Effectiveness and reliability require pilot test to determine.	Moderately difficult to implement. Requires construction of treatment equipment.	High capital, High O&M.
	Recycle/Recover	Asphalt Manufacturer*	Effectiveness requires pilot test to determine	Implementable only if asphalt manufacturer willing to accept materials identified	Moderate capital

* Selected representative technologies.

TABLE 12

Evaluation of Process Options - Waste Piles

General Response:

Action-Waste Piles	Remedial Tech.	Process Option	Effectiveness	Implementability	Cost
No Action	None	Not applicable*	Does not achieve remedial action objectives.	Not acceptable to agencies	None
Institutional Action	Access Restrictions	Fencing*	Useful in limiting access. Does not reduce contamination.	Conventional construction. Alone, not acceptable to agencies	Low capital, low O&M
	Access Restrictions	Land Use Restrictions*	Useful in limiting exposures. Does not reduce contamination.	Readily implementable.	Low capital
	Access Restrictions	Deed Restrictions*	Effectiveness depends on continued future implementation. Does not reduce contamination.	Legal requirement	Low capital
	Monitoring	Ground Water* Monitoring	Useful for documented condition. Does not reduce risks by itself.	Alone, not acceptable to agencies	Low capital, Low O&M
Containment Action	Capping	Clay	Effective susceptible to cracking, requires O&M	Difficult implementation due to space restrictions.	Low capital, low O&M
	Capping	Asphalt	Effective susceptible to weathering, requires O&M	Easily implemented,	Low capital, moderate O&
	Capping	Multimedia cap*	Effective, requires O&M	Easily implemented,	Moderate capital, low O&M
	Capping	Concrete	Effective, susceptible to weathering, cracking, requires O&M.	Easily implemented,	Moderate capital, moderate O&
	Land Disposal	Landfill*	Effective and reliable	Easily implemented	High capital
Removal Action	Excavation	Backhoe*	Effective and reliable	Easily implemented	Low capital
	Excavation	Crane*	Effective and reliable	Easily implemented	Low capital
	Excavation	Front-end Loader*	Effective and reliable	Easily implemented	Low capital
	Excavation	Drum grapplers*	Effective and reliable for drum removal	Easily implemented	Low capital
Treatment Action	Recycle/Recovery	Segregation M.A. Industries/ Polycycle/ Cal West	Effective	Moderately difficult to implement. May require construction of equipment	High capital, Moderate O&
	Recycle/Recovery	Asphalt manufacture	Effectiveness requires pilot test to determine	Implementable only if asphalt manufacturer willing to accept materials identified	Moderate capital
	Thermal Treatment	Master Metals*	Effectiveness requires pilot test to determine	Easily implementable for recoverable lead only	High capital

TABLE 13

TARACORP SITE, GRANITE CITY
REMEDIAL ALTERNATIVE MATRIX

GENERAL RESPONSE ACTION			A	B	C	D	E	F	G
MEDIUM	TECHNOLOGY	PROCESS							
TARACORP PILE BULK	PREVENT EXPOSURE	FENCE AND DEED RESTRICTIONS	●	●	●	●	●	●	
	EXCAVATION AND TRUCK	HEAVY EQUIPMENT					●	●	●
	DISPOSAL	OFF-SITE RCRA LANDFILL							●
	RECYCLE	ON-SITE SEPARATION						●	●
		OFF-SITE PROCESSING						●	●
	CONTAINMENT	MEMBRANE CAP		●	●	●	●	●	
		LINER					●	●	
TARACORP PILE DRUMS	EXCAVATE AND TRUCK	HEAVY EQUIPMENT		●	●	●	●	●	●
	RECYCLE	SECONDARY PB SMELTER		●	●	●	●	●	●
AREA 1 SLAG PILES	EXCAVATE AND MOVE	HEAVY EQUIPMENT		●	●	●	●	●	●
	DISPOSAL	ON-SITE WITH TARACORP PILE		●	●	●	●	●	
		OFF-SITE RCRA LANDFILL							●
	RECYCLE	OFF-SITE PROCESS						●	●
VENICE UN-PAVED ALLEYS	EXCAVATE AND RESTORE	HEAVY EQUIPMENT			●	●	●	●	●
	DISPOSAL	ON-SITE WITH TARACORP PILE			●	●	●	●	
		OFF-SITE RCRA LANDFILL							●
	CONTAINMENT	ASPHALT OR SOD BASED ON USAGE		●					
EAGLE PARK FILL AREA	PREVENT EXPOSURE	FENCE AND DEED RESTRICTIONS	●	●					
	EXCAVATE AND RESTORE	HEAVY EQUIPMENT			●	●	●	●	●
	DISPOSAL	ON-SITE WITH TARACORP PILE			●	●	●	●	
		OFF-SITE RCRA LANDFILL							●
	CONTAINMENT	VEGETATED CLAY CAP		●					
AREA 1 UN-PAVED SURF-ACES	PREVENT EXPOSURE	FENCE AND DEED RESTRICTIONS	●	●					
	EXCAVATE AND RESTORE	HEAVY EQUIPMENT			●	●	●	●	●
	DISPOSAL	ON-SITE WITH TARACORP PILE			●	●	●	●	
		OFF-SITE RCRA LANDFILL							●
	CONTAINMENT	ASPHALT OR SOD BASED ON USAGE		●					
AREA 2 UN-PAVED PUBLIC AREAS	EXCAVATION AND RESTORE	HEAVY EQUIPMENT AND MANUAL			●	●	●	●	●
	DISPOSAL	ON-SITE WITH TARACORP PILE			●	●	●	●	
		OFF-SITE NON-RCRA LANDFILL							●
	CONTAINMENT	ASPHALT OR SOD BASED ON USAGE		●					
AREA 3 UN-PAVED PUBLIC AREAS	EXCAVATION AND RESTORE	HEAVY EQUIPMENT AND MANUAL				●	●	●	●
	DISPOSAL	ON-SITE WITH TARACORP PILE				●	●	●	
		OFF-SITE NON-RCRA LANDFILL							●
	CONTAINMENT	ASPHALT OR SOD BASED ON USAGE		●	●				

TABLE 14
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE A
NO ACTION ALTERNATIVE

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
DIRECT CAPITAL COSTS				
Mobilization	Lump Sum	Lump Sum	$5,000	$5,000
Fencing (Taracorp Pile)	2,000	Ft	$10	$20,000
Fencing (Eagle Park)	2,040	Ft	$10	$20,400
Fencing (Area 1)	3,500	Ft	$10	$35,000
Monitoring Well	30	LF	$60	$1,800
Deed Restrictions	Lump Sum	Lump Sum	$15,000	$15,000
Safety program	Lump Sum	Lump Sum	$1,000	$1,000
Equipment Decontamination	Lump Sum	Lump Sum	$1,000	$1,000
ESTIMATED DIRECT CAPITAL COST				$99,200
INDIRECT CAPITAL COSTS				
Contingency Allowance (25%)				$24,800
Engineering Fees (15%)				$14,880
Legal Fees (5%)				$4,960
ESTIMATED INDIRECT CAPITAL COST				$44,640
TOTAL ESTIMATED CAPITAL COST				$143,840
ANNUAL OPERATING AND MAINTENANCE COSTS				
Air monitoring	2	Mandays	$250	$500
Sample analysis	8	Samples	$1,000	$8,000
Groundwater sample collection	8	Mandays	$250	$2,000
Sample analysis	22	Samples	$150	$3,300
Miscellaneous site work	15	Mandays	$250	$3,750
Site work materials	Lump Sum	Lump Sum	$4,000	$4,000
Estimated Annual Operating and Maintenance Costs				$21,550
PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COSTS FOR 30 YEARS (i=5%)				$331,270
REMEDIAL ALTERNATIVE A TOTAL ESTIMATED COST				$475,110

R.S. Means Co., Inc., 1988. Building Construction Cost Data - 1989.
O'Brien & Gere Engineers, Inc. - Professional Experience

TABLE 15
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE B

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
DIRECT CAPITAL COSTS				
TARACORP PILE MULTI MEDIA CAP				
Grading/contouring/consolidation	19,440	SY	$3	$58,320
Buy/haul/place 24" clay	12,960	CY	$20	$259,200
Buy/place 40-mil synthetic cover	175,000	SF	$1	$175,000
Buy/haul/place 6" gravel	3,240	CY	$15	$48,600
Buy/haul/place Geotextile filter fabric	175,000	SF	$0.20	$35,000
Buy/haul/place 6" embankment	3,240	CY	$10	$32,400
Buy/haul/place 6" topsoil	3,240	CY	$20	$64,800
Seed, fertilizer, mulch	19,440	SY	$1	$19,440
Fencing	2,000	FT	$10	$20,000
SUBTOTAL				$712,760
CONTAINED DROSSES				
Loading (Crane & Crew)	Lump Sum	Lump Sum	$800	$800
Transport to secondary smelter (600 miles @ $3.50/loaded mile	1	Load	$2,100	$2,100
Smelting (adjusted for recovery)	12	Ton	$300	$3,600
SUBTOTAL				$6,500
SLLR PILES				
Excavation	3,920	CY	$25	$98,000
Transport to Taracorp pile	3,920	CY	$3	$11,760
SUBTOTAL				$109,760
VENICE ALLEYS SOD/ASPHALT COVER				
Clear/replace incidentals	1.6	Acres	$5,000	$8,000
Asphalt pavement	5,300	SY	$8	$42,400
Buy/haul/place 3" topsoil	225	CY	$25	$5,620
Buy/haul/place sod	2,700	SY	$4	$10,800
SUBTOTAL				$66,820
EAGLE PARK VEGETATED CLAY CAP				
Purchase property	.5	Acres	$15,000	$7,500
Clear	.5	Acres	$3,000	$1,500
Buy/haul/place/compact 9" clay with maximum permeability of E-7 cm/sec	560	CY	$20	$11,200
Buy/haul/place 6" gravel	370	CY	$15	$5,550
Buy/place Geotextile filter fabric	20,000	SF	$0.20	$4,000
Buy/haul place 6" embankment	370	CY	$10	$3,700
Buy/haul/place 6" topsoil	370	CY	$20	$7,400
Seed, fertilizer, mulch	2,220	SY	$1	$2,220
Fencing	2,040	FT	$10	$20,400
SUBTOTAL				$63,470
AREA 1 SOD/ASPHALT COVER				
Clear/replace incidentals	13.5	Acres	$5,000	$67,500
Excavate for driveway preparation	2,267	CY	$30	$68,010
Load and transport to Taracorp pile	2,267	CY	$6	$13,600
Grade and apply base course	27,200	SY	$3	$81,600
Buy/haul/place asphalt pavement	27,200	SY	$8	$217,600
Buy/haul/place 3" topsoil	3,184	CY	$20	$63,680
Buy/haul/place sod	38,210	SY	$4	$152,840
Fencing	3,500	FT	$10	$35,000
SUBTOTAL				$699,830

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
AREA 2 SOD/ASPHALT COVER				
Clear/replace incidentals	24.3	Acres	$5,000	$121,500
Excavate for driveway preparation	4,160	CY	$30	$124,800
Load and transport to Taracorp pile	4,160	CY	$6	$24,960
Grade and apply base course	49,940	SY	$3	$149,820
Buy/haul/place asphalt pavement	49,940	SY	$8	$399,520
Buy/haul/place 3" topsoil	5,640	CY	$35	$197,400
Buy/haul/place sod	67,700	SY	$4	$270,800
SUBTOTAL				$1,288,800
AREA 3 SOD/ASPHALT COVER				
Clear/replace incidentals	11.5	Acres	$5,000	$57,500
Excavate for driveway preparation	290	CY	$30	$8,700
Load and transport to Taracorp pile	290	CY	$6	$1,740
Grade and apply base course	3,500	SY	$3	$10,500
Buy/haul/place asphalt pavement	3,500	SY	$8	$28,000
Buy/haul/place 3" topsoil	4,340	CY	$35	$151,900
Buy/haul/place sod	52,100	SY	$4	$208,400
SUBTOTAL				$466,740
OTHER COSTS				
Monitoring Well	30	LF	$60	$1,800
Deed Restrictions	Lump Sum	Lump Sum	$15,000	$15,000
Safety Program	Lump Sum	Lump Sum	$20,000	$20,000
Mobilization	Lump Sum	Lump Sum	$35,000	$35,000
Dust Control	Lump Sum	Lump Sum	$20,000	$20,000
Equipment Decontamination	Lump Sum	Lump Sum	$15,000	$15,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$25,000	$25,000
SUBTOTAL				$131,800
ESTIMATED DIRECT CAPITAL COST				$3,546,480
INDIRECT CAPITAL COSTS				
Contingency Allowance (25%)				$886,620
Engineering Fees (15%)				$531,970
Legal Fees (5%)				$177,320
ESTIMATED INDIRECT CAPITAL COST				$1,595,910
TOTAL ESTIMATED CAPITAL COST				$5,142,390
ANNUAL OPERATING AND MAINTENANCE COSTS				
Air monitoring	2	Mandays	$250	$500
Sample analysis	8	Samples	$1,000	$8,000
Groundwater sample collection	8	Mandays	$250	$2,000
Sample analysis	22	Samples	$150	$3,300
Site mowing	26	Mandays	$250	$6,500
Site Inspection	8	Mandays	$250	$2,000
Miscellaneous site work	36	Mandays	$250	$9,000
Site work materials	Lump Sum	Lump Sum	$4,000	$4,000

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
Estimated Annual Operating and Maintenance Costs				$35,300
PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COSTS FOR 30 YEARS (i=5%)				$542,630
REMEDIAL ALTERNATIVE B TOTAL ESTIMATED COST				$5,685,020

R.S. Means Co., Inc., 1988. Site Work Cost Data - 1989.
O'Brien & Gere Engineers, Inc. - Professional Experience

TABLE 16
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE C

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
DIRECT CAPITAL COSTS				
TARACORP PILE MULTI MEDIA CAP				
Grading/contouring/consolidation	19,440	SY	$3	$58,320
Buy/haul/place 24" clay	12,960	CY	$20	$259,200
Buy/place 40-mil synthetic cover	175,000	SF	$1	$175,000
Buy/haul/place 6" gravel	3,240	CY	$15	$48,600
Buy/haul/place Geotextile filter fabric	175,000	SF	$0.20	$35,000
Buy/haul/place 6" embankment	3,240	CY	$10	$32,400
Buy/haul/place 6" topsoil	3,240	CY	$20	$64,800
Seed, fertilizer, mulch	19,440	SY	$1	$19,440
Fencing	2,000	FT	$10	$20,000
SUBTOTAL				$712,760
CONTAINED DROSSES				
Loading (Crane & Crew)	Lump Sum	Lump Sum	$800	$800
Transport to secondary smelter (600 miles @ $3.50/loaded mile)	1	Load	$2,100	$2,100
Smelting (adjusted for recovery)	12	Ton	$300	$3,600
SUBTOTAL				$6,500
SLLR PILES				
Excavation	3,920	CY	$25	$98,000
Transport to Taracorp pile	3,920	CY	$3	$11,760
SUBTOTAL				$109,760
VENICE ALLEYS EXCAVATE AND RESTORE				
Clear/replace incidentals	1.6	Acres	$5,000	$8,000
Excavate to depth of 3"	670	CY	$30	$20,100
Load and transport to Taracorp pile	670	CY	$6	$4,020
Grade and apply base course	5,300	SY	$3	$15,900
Buy/haul/place asphalt	5,300	SY	$8	$42,400
Buy/haul/place 3" topsoil	225	CY	$25	$5,620
Buy/haul/place sod	2,700	SY	$4	$10,800
SUBTOTAL				$106,840
EAGLE PARK EXCAVATE AND RESTORE				
Clear	.5	Acres	$3,000	$1,500
Manual excavation	100	CY	$60	$6,000
Light equipment excavation	500	CY	$30	$15,000
Heavy equipment excavation	2,100	CY	$20	$42,000
Load and transport to Taracorp pile	2,700	CY	$6	$16,200
Buy/haul/place backfill	2,500	CY	$10	$25,000
Buy/haul/place 3" topsoil	200	CY	$20	$4,000
Buy/haul/place sod	2,220	SY	$4	$8,880
SUBTOTAL				$118,580
AREA 1 EXCAVATE AND RESTORE				
Clear/replace incidentals	13.5	Acres	$5,000	$67,500
Manual excavation	160	CY	$60	$9,600
Light equipment excavation	2,427	CY	$30	$72,810
Heavy equipment excavation	2,864	CY	$20	$57,280
Load and transport to Taracorp pile	5,467	CY	$6	$32,800
Grade and apply base course	27,200	SY	$3	$81,600
Buy/haul/place asphalt pavement	27,200	SY	$8	$217,600
Buy/haul/place 3" topsoil	3,184	CY	$20	$63,680

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
Buy/haul/place sod	38,210	SY	$4	$152,840
Buy/haul/place shrubs	10	EA	$50	$500
Buy/haul/place trees	5	EA	$200	$1,000
SUBTOTAL				$757,210
AREA 2 EXCAVATE AND RESTORE				
Clear/replace incidentals	24.3	Acres	$5,000	$121,500
Manual excavation	3,000	CY	$60	$180,000
Light equipment excavation	6,800	CY	$30	$204,000
Load and transport to Taracorp pile	9,800	CY	$6	$58,800
Buy/haul/place 3" topsoil	5,640	CY	$35	$197,400
Buy/haul/place sod	67,700	SY	$4	$270,800
Buy/haul/place shrubs	150	EA	$50	$7,500
Buy/haul/place trees	70	EA	$200	$14,000
Grade and apply pavement base course	49,940	SY	$3	$149,820
Asphalt pavement	49,940	SY	$8	$399,520
SUBTOTAL				$1,603,340
AREA 3 SOD/ASPHALT COVER				
Clear/replace incidentals	11.5	Acres	$5,000	$57,500
Excavate for driveway preparation	290	CY	$30	$8,700
Load and transport to Taracorp pile	290	CY	$6	$1,740
Grade and apply base course	3,500	SY	$3	$10,500
Buy/haul/place asphalt pavement	3,500	SY	$8	$28,000
Buy/haul/place 3" topsoil	4,340	CY	$35	$151,900
Buy/haul/place sod	52,100	SY	$4	$208,400
SUBTOTAL				$466,740
OTHER COSTS				
Monitoring Well	30	LF	$60	$1,800
Deed Restrictions	Lump Sum	Lump Sum	$15,000	$15,000
Safety Program	Lump Sum	Lump Sum	$35,000	$35,000
Mobilization	Lump Sum	Lump Sum	$60,000	$60,000
Dust Control	Lump Sum	Lump Sum	$35,000	$35,000
Equipment Decontamination	Lump Sum	Lump Sum	$35,000	$35,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$25,000	$25,000
SUBTOTAL				$206,800
ESTIMATED DIRECT CAPITAL COST				$4,088,530
INDIRECT CAPITAL COSTS				
Contingency Allowance (25%)				$1,022,130
Engineering Fees (15%)				$613,280
Legal Fees (5%)				$204,430
ESTIMATED INDIRECT CAPITAL COST				$1,839,840
TOTAL ESTIMATED CAPITAL COST				$5,928,370
ANNUAL OPERATING AND MAINTENANCE COSTS				
Air monitoring	2	Mandays	$250	$500
Sample analysis	8	Samples	$1,000	$8,000
Groundwater sample collection	8	Mandays	$250	$2,000
Sample analysis	22	Samples	$150	$3,300
Site mowing	26	Mandays	$250	$6,500

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
Site inspection	8	Mandays	$250	$2,000
Miscellaneous site work	36	Mandays	$250	$9,000
Site work materials	Lump Sum	Lump Sum	$4,000	$4,000
Estimated Annual Operating and Maintenance Costs				$35,300
PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COSTS FOR 30 YEARS (i=5%)				$542,630
REMEDIAL ALTERNATIVE C TOTAL ESTIMATED COST				$6,471,000

R.S. Means Co., Inc., 1988. Building Construction Cost Data - 1989.
O'Brien & Gere Engineers, Inc. - Professional Experience

TABLE 17
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE D

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
DIRECT CAPITAL COSTS				
TARACORP PILE MULTI MEDIA CAP				
Grading/contouring/consolidation	19,440	SY	$3	$58,320
Buy/haul/place 24" clay	12,960	CY	$20	$259,200
Buy/place 40-mil synthetic cover	175,000	SF	$1	$175,000
Buy/haul/place 6" gravel	3,240	CY	$15	$48,600
Buy/haul/place Geotextile filter fabric	175,000	SF	$0.20	$35,000
Buy/haul/place 6" embankment	3,240	CY	$10	$32,400
Buy/haul/place 6" topsoil	3,240	CY	$20	$64,800
Seed, fertilizer, mulch	19,440	SY	$1	$19,440
Fencing	2,000	FT	$10	$20,000
SUBTOTAL				$712,760
CONTAINED DROSSES				
Loading (Crane & Crew)	Lump Sum	Lump Sum	$800	$800
Transport to secondary smelter (600 miles @ $3.50/loaded mile	1	Load	$2,100	$2,100
Smelting (adjusted for recovery)	12	Ton	$300	$3,600
SUBTOTAL				$6,500
SLLR PILES				
Excavation	3,920	CY	$25	$98,000
Transport to Taracorp pile	3,920	CY	$3	$11,760
SUBTOTAL				$109,760
VENICE ALLEYS EXCAVATE AND RESTORE				
Clear/replace incidentals	1.6	Acres	$5,000	$8,000
Excavate to depth of 3"	670	CY	$30	$20,100
Load and transport to Taracorp pile	670	CY	$6	$4,020
Grade and apply base course	5,300	SY	$3	$15,900
Buy/haul/place asphalt	5,300	SY	$8	$42,400
Buy/haul/place 3" topsoil	225	CY	$25	$5,620
Buy/haul/place sod	2,700	SY	$4	$10,800
SUBTOTAL				$106,840
EAGLE PARK EXCAVATE AND RESTORE				
Clear	.5	Acres	$3,000	$1,500
Manual excavation	100	CY	$60	$6,000
Light equipment excavation	500	CY	$30	$15,000
Heavy equipment excavation	2,100	CY	$20	$42,000
Load and transport to Taracorp pile	2,700	CY	$6	$16,200
Buy/haul/place backfill	2,500	CY	$10	$25,000
Buy/haul/place 3" topsoil	200	CY	$20	$4,000
Buy/haul/place sod	2,220	SY	$4	$8,880
SUBTOTAL				$118,580
AREA 1 EXCAVATE AND RESTORE				
Clear/replace incidentals	13.5	Acres	$5,000	$67,500
Manual excavation	160	CY	$60	$9,600
Light equipment excavation	2,427	CY	$30	$72,810
Heavy equipment excavation	2,864	CY	$20	$57,280
Load and transport to Taracorp pile	5,467	CY	$6	$32,800
Grade and apply base course	27,200	SY	$3	$81,600
Buy/haul/place asphalt pavement	27,200	SY	$8	$217,600
Buy/haul/place 3" topsoil	3,184	CY	$20	$63,680
Buy/haul/place sod	38,210	SY	$4	$152,840

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
Buy/haul/place shrubs	10	EA	$50	$500
Buy/haul/place trees	5	EA	$200	$1,000
SUBTOTAL				$757,210
AREA 2 EXCAVATE AND RESTORE				
Clear/replace incidentals	24.3	Acres	$5,000	$121,500
Manual excavation	3,000	CY	$60	$180,000
Light equipment excavation	6,800	CY	$30	$204,000
Load and transport to Taracorp pile	9,800	CY	$6	$58,800
Buy/haul/place 3" topsoil	5,640	CY	$35	$197,400
Buy/haul/place sod	67,700	SY	$4	$270,800
Buy/haul/place shrubs	150	EA	$50	$7,500
Buy/haul/place trees	70	EA	$200	$14,000
Grade and apply pavement base course	49,940	SY	$3	$149,820
Asphalt pavement	49,940	SY	$8	$399,520
SUBTOTAL				$1,603,340
AREA 3 EXCAVATE AND RESTORE				
Clear/replace incidentals	11.5	Acres	$5,000	$57,500
Manual excavation	2,175	CY	$60	$130,500
Light equipment excavation	2,465	CY	$30	$73,950
Load and transport to Taracorp pile	4,640	CY	$6	$27,840
Buy/haul/place 3" topsoil	4,340	CY	$35	$151,900
Buy/haul/place sod	52,100	SY	$4	$208,400
Buy/haul/place shrubs	70	EA	$50	$3,500
Buy/haul/place trees	30	EA	$200	$6,000
Grade and apply pavement base course	3,500	SY	$3	$10,500
Asphalt pavement	3,500	SY	$8	$28,000
SUBTOTAL				$698,090
OTHER COSTS				
Monitoring Well	30	LF	$60	$1,800
Deed Restrictions	Lump Sum	Lump Sum	$15,000	$15,000
Safety Program	Lump Sum	Lump Sum	$40,000	$40,000
Mobilization	Lump Sum	Lump Sum	$65,000	$65,000
Dust Control	Lump Sum	Lump Sum	$40,000	$40,000
Equipment Decontamination	Lump Sum	Lump Sum	$40,000	$40,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$25,000	$25,000
SUBTOTAL				$226,800
ESTIMATED DIRECT CAPITAL COST				$4,339,880
<u>INDIRECT CAPITAL COSTS</u>				
Contingency Allowance (25%)				$1,084,970
Engineering Fees (15%)				$650,980
Legal Fees (5%)				$216,990
ESTIMATED INDIRECT CAPITAL COST				$1,952,940
TOTAL ESTIMATED CAPITAL COST				$6,292,820

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
ANNUAL OPERATING AND MAINTENANCE COSTS				
Air monitoring	2	Mandays	$250	$500
Sample analysis	8	Samples	$1,000	$8,000
Groundwater sample collection	8	Mandays	$250	$2,000
Sample analysis	22	Samples	$150	$3,300
Site mowing	26	Mandays	$250	$6,500
Site inspection	8	Mandays	$250	$2,000
Miscellaneous site work	36	Mandays	$250	$9,000
Site work materials	Lump Sum	Lump Sum	$4,000	$4,000
Estimated Annual Operating and Maintenance Costs				$35,300
PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COSTS FOR 30 YEARS (i=5%)				$542,630
REMEDIAL ALTERNATIVE D TOTAL ESTIMATED COST				$6,835,450

R.S. Means Co., Inc., 1988. Building Construction Cost Data - 1989.
O'Brien & Gere Engineers, Inc. - Professional Experience

TABLE 18
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE E

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
DIRECT CAPITAL COSTS				
TARACORP PILE MULTI MEDIA CAP WITH SUPPLEMENTAL LINER				
Building demolition	650,000	CF	$0.25	$162,500
Buy/haul/place 2' clay with maximum permeability E-7 cm/sec	18,500	CY	$20	$370,000
Buy/haul/place 1' sand	9,250	CY	$15	$138,750
Install secondary drainage system (4" PVC piping wrapped in filter fabric)	25,000	FT	$5	$125,000
Buy/place 60 mil synthetic liner	249,725	SF	$1.25	$312,160
Buy/haul/place 1' sand	9,250	CY	$15	$138,750
Install primary drainage system (4" PVC piping wrapped in filter fabric)	25,000	FT	$5	$125,000
Buy/place Geotextile filter fabric	249,725	SF	$0.20	$49,940
Excavate Taracorp pile and transport	85,000	CY	$30	$2,550,000
Excavate soil below Taracorp pile to depth of 1', transport, apply as cover, grade	6,480	CY	$25	$162,000
Backfill Taracorp pile excavation with 9" fill	5,130	CY	$10	$51,300
Buy/haul/place 3" topsoil	1,620	CY	$20	$32,400
Seed, fertilizer, mulch	19,450	SY	$1	$19,450
Buy/haul/place 24" clay	17,670	CY	$20	$353,400
Buy/place 40-mil synthetic cover	238,620	SF	$1	$238,620
Buy/haul/place 6" gravel	4,419	CY	$15	$66,280
Buy/haul/place Geotextile filter fabric	238,620	SF	$0.20	$47,720
Buy/haul/place 6" embankment	4,419	CY	$10	$44,190
Buy/haul/place 6" topsoil	4,419	CY	$20	$88,380
Seed, fertilizer, mulch	26,513	SY	$1	$26,510
Fencing	2,600	FT	$10	$26,000
SUBTOTAL				$5,128,350
CONTAINED DROSSES				
Loading (Crane & Crew)	Lump Sum	Lump Sum	$800	$800
Transport to secondary smelter (600 miles @ $3.50/loaded mile	1	Load	$2,100	$2,100
Smelting (adjusted for recovery)	12	Ton	$300	$3,600
SUBTOTAL				$6,500
SLLR PILES				
Excavation	3,920	CY	$25	$98,000
Transport to Taracorp pile	3,920	CY	$3	$11,760
SUBTOTAL				$109,760

ITEM	QUANTITY	UNITS	COST	COST
VENICE ALLEYS EXCAVATE AND RESTORE				
Clear/replace incidentals	1.6	Acres	$5,000	$8,000
Excavate to depth of 3"	670	CY	$30	$20,100
Load and transport to Taracorp pile	670	CY	$6	$4,020
Grade and apply base course	5,300	SY	$3	$15,900
Buy/haul/place asphalt	5,300	SY	$8	$42,400
Buy/haul/place 3" topsoil	225	CY	$25	$5,620
Buy/haul/place sod	2,700	SY	$4	$10,800
SUBTOTAL				$106,840
EAGLE PARK EXCAVATE AND RESTORE				
Clear	.5	Acres	$3,000	$1,500
Manual excavation	100	CY	$60	$6,000
Light equipment excavation	500	CY	$30	$15,000
Heavy equipment excavation	2,100	CY	$20	$42,000
Load and transport to Taracorp pile	2,700	CY	$6	$16,200
Buy/haul/place backfill	2,500	CY	$10	$25,000
Buy/haul/place 3" topsoil	200	CY	$20	$4,000
Buy/haul/place sod	2,220	SY	$4	$8,880
SUBTOTAL				$118,580
AREA 1 EXCAVATE AND RESTORE (IN CONJUNCTION WITH LINER INSTALLATION)				
Clear/replace incidentals	13.5	Acres	$5,000	$67,500
Manual excavation	160	CY	$60	$9,600
Light equipment excavation	2,427	CY	$30	$72,810
Heavy equipment excavation	2,864	CY	$20	$57,280
Load and transport to Taracorp pile	5,467	CY	$6	$32,800
Grade and apply base course	27,200	SY	$3	$81,600
Buy/haul/place asphalt pavement	27,200	SY	$8	$217,600
Buy/haul/place 3" topsoil	872	CY	$20	$17,440
Buy/haul/place sod	10,460	SY	$4	$41,840
SUBTOTAL				$598,470
AREA 2 EXCAVATE AND RESTORE				
Clear/replace incidentals	24.3	Acres	$5,000	$121,500
Manual excavation	3,000	CY	$60	$180,000
Light equipment excavation	6,800	CY	$30	$204,000
Load and transport to Taracorp pile	9,800	CY	$6	$58,800
Buy/haul/place 3" topsoil	5,640	CY	$35	$197,400
Buy/haul/place sod	67,700	SY	$4	$270,800
Buy/haul/place shrubs	150	EA	$50	$7,500
Buy/haul/place trees	70	EA	$200	$14,000
Grade and apply pavement base course	49,940	SY	$3	$149,820
Asphalt pavement	49,940	SY	$8	$399,520
SUBTOTAL				$1,603,340

ITEM	QUANTITY	UNITS	COST	COST
AREA 3 EXCAVATE AND RESTORE				
Clear/replace incidentals	11.5	Acres	$5,000	$57,500
Manual excavation	2,175	CY	$60	$130,500
Light equipment excavation	2,465	CY	$30	$73,950
Load and transport to Taracorp pile	4,640	CY	$6	$27,840
Buy/haul/place 3" topsoil	4,340	CY	$35	$151,900
Buy/haul/place sod	52,100	SY	$4	$208,400
Buy/haul/place shrubs	70	EA	$50	$3,500
Buy/haul/place trees	30	EA	$200	$6,000
Grade and apply pavement base course	3,500	SY	$3	$10,500
Asphalt pavement	3,500	SY	$8	$28,000
SUBTOTAL				$698,090
OTHER COSTS				
Monitoring Well	30	LF	$60	$1,800
Deed Restrictions	Lump Sum	Lump Sum	$15,000	$15,000
Safety Program	Lump Sum	Lump Sum	$70,000	$70,000
Mobilisation	Lump Sum	Lump Sum	$45,000	$45,000
Dust Control	Lump Sum	Lump Sum	$70,000	$70,000
Equipment Decontamination	Lump Sum	Lump Sum	$40,000	$40,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$25,000	$25,000
SUBTOTAL				$266,800
ESTIMATED DIRECT CAPITAL COST				$8,636,730
INDIRECT CAPITAL COSTS				
Contingency Allowance (25%)				$2,159,180
Engineering Fees (15%)				$1,295,510
Legal Fees (5%)				$431,840
ESTIMATED INDIRECT CAPITAL COST				$3,886,530
TOTAL ESTIMATED CAPITAL COST				$12,523,260
ANNUAL OPERATING AND MAINTENANCE COSTS				
Air monitoring	2	Mandays	$250	$500
Sample analysis	8	Samples	$1,000	$8,000
Groundwater sample collection	8	Mandays	$250	$2,000
Sample analysis	22	Samples	$150	$3,300
Site mowing	26	Mandays	$250	$6,500
Site inspection	8	Mandays	$250	$2,000
Miscellaneous site work	36	Mandays	$250	$9,000
Site work materials	Lump Sum	Lump Sum	$4,000	$4,000
Estimated Annual Operating and Maintenance Costs				$35,300
PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COSTS FOR 30 YEARS (i=5%)				$542,630
REMEDIAL ALTERNATIVE E TOTAL ESTIMATED COST				$13,065,890

R.S. Means Co., Inc., 1988. Building Construction Cost Data - 1989.
O'Brien & Gere Engineers, Inc. - Professional Experience

TABLE 19
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE F

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
DIRECT CAPITAL COSTS				
TARACORP PILE MULTI MEDIA CAP WITH SUPPLEMENTAL LINER				
Building demolition	650,000	CF	$0.25	$162,500
Buy/haul/place 2' clay with maximum permeability E-7 cm/sec	17,026	CY	$20	$340,520
Buy/haul/place 1' sand	8,513	CY	$15	$127,700
Install secondary drainage system (4" PVC piping wrapped in filter fabric)	24,000	FT	$5	$120,000
Buy/place 60 mil synthetic liner	229,850	SF	$1.25	$287,310
Buy/haul/place 1' sand	8,513	CY	$15	$127,700
Install primary drainage system (4" PVC piping wrapped in filter fabric)	24,000	FT	$5	$120,000
Buy/place Geotextile filter fabric	229,850	SF	$0.20	$45,970
Excavate/visually segregate slag from Taracorp pile and transport	34,000	CY	$35	$1,190,000
Excavate/visually segregate battery casings, lead dross, entrained slag	51,000	CY	$35	$1,785,000
Screen Unit	Lump Sum	Lump Sum	$50,000	$50,000
Battery material classification unit (38.5 ton/hr. unit)	Lump Sum	Lump Sum	$650,000	$650,000
Rinse water clarifier/treatment system	Lump Sum	Lump Sum	$50,000	$50,000
Electricity (300 kw/hr)	1,344,000	KWH	$0.08	$107,520
Wastewater treatment (2,000 GPD for 10% slurry/rinse water changeout)	1,120,000	Gal	$0.20	$224,000
Labor for screening and classification (5 man crew @ $130.00/hr., 560 working days. Assume operate at 80% capacity.)	Lump Sum	Lump Sum	$582,400	$582,400
Equipment installation and maintenance	Lump Sum	Lump Sum	$150,000	$150,000
Load and transport residual slag, rubber casings, unrecovered product to disposal area	37,196	CY	$15	$557,940
Load plastics	8,704	CY	$3	$26,110
Transport plastics ($3.50/loaded mile, 16 CY trucks, 500 mile haul)	544	Loads	$1,750	$952,000
Profit from plastic	7,520	Tons	$400	($3,008,000)
Load recovered lead/lead oxide/slag mix	5,100	CY	$15	$76,500
Transport to secondary smelter (600 miles @ 3.50/loaded mile)	320	Loads	$2,100	$672,000
Smelting fee	28,640	Tons	$600	$17,184,000
Profit from lead	11,800	Tons	$740	($8,732,000)
Excavate soil below Taracorp pile to depth of 1', transport, apply as cover, grade	6,480	CY	$25	$162,000
Backfill Taracorp pile excavation with 9" fill	5,130	CY	$10	$51,300
Buy/haul/place 3" topsoil	1,620	CY	$20	$32,400
Seed, fertiliser, mulch	19,450	SY	$1	$19,450
Buy/haul/place/compact 24" clay	15,997	CY	$20	$319,940
Buy/place 40-mil synthetic cover	215,965	SF	$1	$215,970
Buy/haul/place 6" gravel	3,999	CY	$15	$59,990
Buy/haul/place Geotextile filter fabric	215,965	SF	$0.20	$43,190
Buy/haul/place 6" embankment	3,999	CY	$10	$39,990
Buy/haul/place 6" topsoil	3,999	CY	$20	$79,980
Seed, fertiliser, mulch	23,996	SY	$1	$24,000
Fencing	2,600	FT	$10	$26,000
SUBTOTAL				$14,923,380

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
CONTAINED DROSSES				
Loading (Crane & Crew)	Lump Sum	Lump Sum	$800	$800
Transport to secondary smelter (600 miles @ $3.50/loaded mile	1	Load	$2,100	$2,100
Smelting (adjusted for recovery)	12	Ton	$300	$3,600
SUBTOTAL				$6,500
SLLR PILES				
Excavation	3,920	CY	$25	$98,000
Transport to Taracorp pile	3,920	CY	$3	$11,760
SUBTOTAL				$109,760
VENICE ALLEYS EXCAVATE AND RESTORE				
Clear/replace incidentals	1.6	Acres	$5,000	$8,000
Excavate to depth of 3"	670	CY	$30	$20,100
Load and transport to Taracorp pile	670	CY	$6	$4,020
Grade and apply base course	5,300	SY	$3	$15,900
Buy/haul/place asphalt	5,300	SY	$8	$42,400
Buy/haul/place 3" topsoil	225	CY	$25	$5,620
Buy/haul/place sod	2,700	SY	$4	$10,800
SUBTOTAL				$106,840
EAGLE PARK EXCAVATE AND RESTORE				
Clear	.5	Acres	$3,000	$1,500
Manual excavation	100	CY	$60	$6,000
Light equipment excavation	500	CY	$30	$15,000
Heavy equipment excavation	2,100	CY	$20	$42,000
Load and transport to Taracorp pile	2,700	CY	$6	$16,200
Buy/haul/place backfill	2,500	CY	$10	$25,000
Buy/haul/place 3" topsoil	200	CY	$20	$4,000
Buy/haul/place sod	2,220	SY	$4	$8,880
SUBTOTAL				$118,580
AREA 1 EXCAVATE AND RESTORE (IN CONJUNCTION WITH LINER INSTALLATION)				
Clear/replace incidentals	13.5	Acres	$5,000	$67,500
Manual excavation	160	CY	$60	$9,600
Light equipment excavation	2,427	CY	$30	$72,810
Heavy equipment excavation	2,864	CY	$20	$57,280
Load and transport to Taracorp pile	5,467	CY	$6	$32,800
Grade and apply base course	27,200	SY	$3	$81,600
Buy/haul/place asphalt pavement	27,200	SY	$8	$217,600
Buy/haul/place 3" topsoil	872	CY	$20	$17,440
Buy/haul/place sod	10,460	SY	$4	$41,840
SUBTOTAL				$598,470
AREA 2 EXCAVATE AND RESTORE				
Clear/replace incidentals	24.3	Acres	$5,000	$121,500
Manual excavation	3,000	CY	$60	$180,000
Light equipment excavation	6,800	CY	$30	$204,000
Load and transport to Taracorp pile	9,800	CY	$6	$58,800
Buy/haul/place 3" topsoil	5,640	CY	$35	$197,400
Buy/haul/place sod	67,700	SY	$4	$270,800
Buy/haul/place shrubs	150	EA	$50	$7,500
Buy/haul/place trees	70	EA	$200	$14,000
Grade and apply pavement base course	49,940	SY	$3	$149,820
Asphalt pavement	49,940	SY	$8	$399,520
SUBTOTAL				$1,603,340

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
AREA 3 EXCAVATE AND RESTORE				
Clear/replace incidentals	11.5	Acres	$5,000	$57,500
Manual excavation	2,175	CY	$60	$130,500
Light equipment excavation	2,465	CY	$30	$73,950
Load and transport to Taracorp pile	4,640	CY	$6	$27,840
Buy/haul/place 3" topsoil	4,340	CY	$35	$151,900
Buy/haul/place sod	52,100	SY	$4	$208,400
Buy/haul/place shrubs	70	EA	$50	$3,500
Buy/haul/place trees	30	EA	$200	$6,000
Grade and apply pavement base course	3,500	SY	$3	$10,500
Asphalt pavement	3,500	SY	$8	$28,000
SUBTOTAL				$698,090
OTHER COSTS				
Monitoring Well	30	LF	$60	$1,800
Deed Restrictions	Lump Sum	Lump Sum	$15,000	$15,000
Safety Program	Lump Sum	Lump Sum	$90,000	$90,000
Mobilization	Lump Sum	Lump Sum	$45,000	$45,000
Dust Control	Lump Sum	Lump Sum	$90,000	$90,000
Equipment Decontamination	Lump Sum	Lump Sum	$45,000	$45,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$25,000	$25,000
SUBTOTAL				$311,800
ESTIMATED DIRECT CAPITAL COST				$18,476,760
INDIRECT CAPITAL COSTS				
Contingency Allowance (25%)				$4,619,190
Engineering Fees (15%)				$2,771,510
Legal Fees (5%)				$923,840
ESTIMATED INDIRECT CAPITAL COST				$8,314,540
TOTAL ESTIMATED CAPITAL COST				$26,791,300
ANNUAL OPERATING AND MAINTENANCE COSTS				
Air monitoring	2	Mandays	$250	$500
Sample analysis	8	Samples	$1,000	$8,000
Groundwater sample collection	8	Mandays	$250	$2,000
Sample analysis	22	Samples	$150	$3,300
Site mowing	26	Mandays	$250	$6,500
Site inspection	8	Mandays	$250	$2,000
Miscellaneous site work	36	Mandays	$250	$9,000
Site work materials	Lump Sum	Lump Sum	$4,000	$4,000
Estimated Annual Operating and Maintenance Costs				$35,300
PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COSTS FOR 30 YEARS (i=5%)				$542,630
REMEDIAL ALTERNATIVE F TOTAL ESTIMATED COST				$27,333,930

R.S. Means Co., Inc., 1988. Building Construction Cost Data - 1989.
O'Brien & Gere Engineers, Inc. - Professional Experience

TABLE 20
NL GRANITE CITY
PRELIMINARY COST ESTIMATE
ALTERNATIVE G

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
DIRECT CAPITAL COSTS				
TARACORP PILE EXCAVATION AND DISPOSAL WITH SEGREGATION AND RECYCLING				
Excavate/visually segregate slag from Taracorp pile	34,000	CY	$35	$1,190,000
Transport slag to RCRA landfill (slag at 4.25 tons/CY, 20 ton truckloads, $3.50/loaded mile, 150 mile haul)	7,225	Loads	$525	$3,793,120
Disposal in RCRA landfill	34,000	CY	$125	$4,250,000
Excavate/visually segregate battery casings, lead dross, entrained slag	51,000	CY	$35	$1,785,000
Screen Unit	Lump Sum	Lump Sum	$50,000	$50,000
Battery material classification unit (38.5 ton/hr. unit)	Lump Sum	Lump Sum	$650,000	$650,000
Rinse water clarifier/treatment system	Lump Sum	Lump Sum	$50,000	$50,000
Electricity (300 kw/hr)	1,344,000	KWH	$0.08	$107,520
Wastewater treatment (2,000 GPD for 10% slurry/rinse water changeout)	1,120,000	Gal	$0.20	$224,000
Labor for screening and classification (5 man crew @ $130.00/hr., 560 working days. Assume operate at 80% capacity.)	Lump Sum	Lump Sum	$582,400	$582,400
Equipment installation and maintenance	Lump Sum	Lump Sum	$150,000	$150,000
Load residual slag, rubber casings, unrecovered product for transport	37,196	CY	$15	$557,940
Transport residuals to RCRA landfill (Residuals at 3.0 tons/CY, 20 ton truckloads, $3.50/loaded mile, 150 mile haul)	6,345	Loads	$525	$3,331,120
Disposal in RCRA landfill	37,196	CY	$125	$4,649,500
Load plastics	8,704	CY	$3	$26,110
Transport plastics ($3.50/loaded mile, 16 CY trucks, 500 mile haul)	544	Loads	$1,750	$952,000
Profit from plastic	7,520	Tons	$400	($3,008,000)
Load recovered lead/lead oxide/slag mix	5,100	CY	$15	$76,500
Transport to secondary smelter (600 miles @ 3.50/loaded mile)	320	Loads	$2,100	$672,000
Smelting fee	28,640	Tons	$600	$17,184,000
Profit from lead	11,800	Tons	$740	($8,732,000)
Excavate soil below Taracorp pile to depth of 1'	6,480	CY	$20	$129,600
Load and transport soil to RCRA landfill (16 CY truckload, $3.50/loaded mile, 150 mile haul)	405	Loads	$525	$212,620
Disposal in RCRA landfill	6,480	CY	$125	$810,000
Backfill Taracorp pile excavation with 9" fill	5,130	CY	$10	$51,300
Buy/haul/place 3" topsoil	1,620	CY	$20	$32,400
Seed, fertilizer, mulch	19,450	SY	$1	$19,450
SUBTOTAL				$29,796,580
CONTAINED DROSSES				
Loading (Crane & Crew)	Lump Sum	Lump Sum	$800	$800
Transport to secondary smelter (600 miles @ $3.50/loaded mile	1	Load	$2,100	$2,100
Smelting (adjusted for recovery)	12	Ton	$300	$3,600
SUBTOTAL				$6,500

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
SLLR PILES				
Excavation	3,920	CY	$25	$98,000
Transport to RCRA landfill (16 CY/truckload, $3.50/loaded mile, 150 mile haul)	245	Loads	$525	$128,630
Disposal in RCRA landfill	3,920	CY	$125	$490,000
SUBTOTAL				$716,630
VENICE ALLEYS EXCAVATE AND RESTORE				
Clear/replace incidentals	1.6	Acres	$5,000	$8,000
Excavate to depth of 3"	670	CY	$30	$20,100
Transport to RCRA landfill (16 CY/truckload, $3.50/loaded mile, 150 mile haul)	42	Loads	$525	$22,050
Disposal in RCRA landfill	670	CY	$125	$83,750
Grade and apply base course	5,300	SY	$3	$15,900
Buy/haul/place asphalt	5,300	SY	$8	$42,400
Buy/haul/place 3" topsoil	225	CY	$25	$5,620
Buy/haul/place sod	2,700	SY	$4	$10,800
SUBTOTAL				$208,620
EAGLE PARK EXCAVATE AND RESTORE				
Clear	.5	Acres	$3,000	$1,500
Manual excavation	100	CY	$60	$6,000
Light equipment excavation	500	CY	$30	$15,000
Heavy equipment excavation	2,100	CY	$20	$42,000
Transport to RCRA landfill (16 CY/truckload, $3.50/loaded mile, 150 mile haul)	169	Loads	$525	$88,730
Disposal in RCRA landfill	2,700	CY	$125	$337,500
Buy/haul/place backfill	2,500	CY	$10	$25,000
Buy/haul/place 3" topsoil	200	CY	$20	$4,000
Buy/haul/place sod	2,220	SY	$4	$8,880
SUBTOTAL				$528,610
AREA 1 EXCAVATE AND RESTORE				
Clear/replace incidentals	8	Acres	$5,000	$40,000
Manual excavation	160	CY	$60	$9,600
Light equipment excavation	160	CY	$30	$4,800
Heavy equipment excavation	2,864	CY	$20	$57,280
Transport to RCRA landfill (16 CY/truckload, $3.50/loaded mile, 150 mile haul)	200	Loads	$525	$105,000
Disposal in RCRA landfill	3,200	CY	$125	$400,000
Buy/haul/place 3" topsoil	3,184	CY	$20	$63,680
Buy/haul/place sod	38,210	SY	$4	$152,840
Buy/haul/place shrubs	10	EA	$50	$500
Buy/haul/place trees	5	EA	$200	$1,000
SUBTOTAL				$834,700
AREA 2 EXCAVATE AND RESTORE				
Clear/replace incidentals	24.3	Acres	$5,000	$121,500
Manual excavation	2,000	CY	$60	$120,000
Light equipment excavation	5,800	CY	$30	$174,000
Heavy equipment excavation	2,000	CY	$20	$40,000
Transport to non-RCRA landfill (16 CY/truckload, $5.00/loaded mile, 20 mile haul)	613	Loads	$100	$61,300
Disposal in non-RCRA landfill	9,800	CY	$10	$98,000

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
Buy/haul/place 3" topsoil	5,640	CY	$35	$197,400
Buy/haul/place sod	67,700	SY	$4	$270,800
Buy/haul/place shrubs	150	EA	$50	$7,500
Buy/haul/place trees	70	EA	$200	$14,000
Grade and apply pavement base course	49,940	SY	$3	$149,820
Asphalt pavement	49,940	SY	$8	$399,520
SUBTOTAL				$1,653,840
AREA 3 EXCAVATE AND RESTORE				
Clear/replace incidentals	11.5	Acres	$5,000	$57,500
Manual excavation	1,450	CY	$60	$87,000
Light equipment excavation	1,740	CY	$30	$52,200
Heavy equipment excavation	1,450	CY	$20	$29,000
Transport to non-RCRA landfill (16 CY/truckload, $5.00/loaded mile, 20 mile haul)	290	Loads	$100	$29,000
Disposal in non-RCRA landfill	4,640	CY	$10	$46,400
Buy/haul/place 3" topsoil	4,340	CY	$35	$151,900
Buy/haul/place sod	52,100	SY	$4	$208,400
Buy/haul/place shrubs	70	EA	$50	$3,500
Buy/haul/place trees	30	EA	$200	$6,000
Grade and apply pavement base course	3,500	SY	$3	$10,500
Asphalt pavement	3,500	SY	$8	$28,000
SUBTOTAL				$709,400
OTHER COSTS				
Monitoring Well	30	LF	$60	$1,800
Deed Restrictions	Lump Sum	Lump Sum	$15,000	$15,000
Safety Program	Lump Sum	Lump Sum	$70,000	$70,000
Mobilization	Lump Sum	Lump Sum	$45,000	$45,000
Dust Control	Lump Sum	Lump Sum	$70,000	$70,000
Equipment Decontamination	Lump Sum	Lump Sum	$45,000	$45,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$25,000	$25,000
SUBTOTAL				$271,800
ESTIMATED DIRECT CAPITAL COST				$34,726,680
INDIRECT CAPITAL COSTS				
Contingency Allowance (25%)				$8,681,670
Engineering Fees (15%)				$5,209,000
Legal Fees (5%)				$1,736,330
ESTIMATED INDIRECT CAPITAL COST				$15,627,000
TOTAL ESTIMATED CAPITAL COST				$50,353,680

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL COST
ANNUAL OPERATING AND MAINTENANCE COSTS				
Groundwater sample collection	8	Mandays	$250	$2,000
Sample analysis	22	Samples	$150	$3,300
Estimated Annual Operating and Maintenance Costs				$5,300
PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COSTS FOR 30 YEARS (i=5%)				$81,470
REMEDIAL ALTERNATIVE G TOTAL ESTIMATED COST				$50,435,150

R.S. Means Co., Inc., 1988. Building Construction Cost Data - 1989.
O'Brien & Gere Engineers, Inc. - Professional Experience

TABLE 21 - EVALUATION AND COMPARISON OF ALTERNATIVES

Assessment Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Implementability							
- Technical feasibility	Standard construction and monitoring techniques only.	Standard construction and monitoring techniques only.	Standard construction and monitoring techniques only.	Standard construction and monitoring techniques only.	Standard construction and monitoring techniques only.	Standard construction and monitoring techniques utilized for excavation, liner, cap. Manual segregation required. Hydroclassification equipment not designed to accept waste materials; equipment reliability questioned. Recovered plastic will not pass TCLP test for lead; lead content of solids may be too low for acceptance by a secondary smelter.	Standard construction and monitoring techniques utilized excavation, transportation. Manual segregation required. Hydroclassification equipment not designed to accept waste materials; equipment reliability questioned. Recovered plastic will not pass TCLP test for lead; lead content of solids may be too low for acceptance by a secondary smelter.
- Administrative feasibility	Construction limited to onsite fencing. No administrative difficulties anticipated.	Coordination with local government, residents required to apply cover in remote areas.	Coordination with local government, residents required to excavate and apply cover in remote areas.	Coordination with local government, residents required to excavate and restore remote areas.	Coordination with local government, residents required to excavate and restore remote areas.	Coordination with local government, residents required to excavate and restore remote areas.	Coordination with local government, residents required to excavate and restore remote areas.
- Availability of services and materials	Services and materials locally available	Services and materials locally available	Services and materials locally available	Services and materials locally available	Services and materials locally available.	Construction services and materials locally available. Segregation and recovery equipment must be shipped.	Construction services and materials locally available. Segregation and recovery equipment must be shipped. RCRA and non-RCRA landfills within 200 miles of site.
Cost							
- Capital cost	$143,840	$5,142,390	$5,928,370	$6,292,820	$12,823,260	$26,791,300	$80,353,680
- Annual O & M	$21,550	$35,300	$35,300	$35,300	$35,300	$35,300	$6,300
- Present worth (i=8%, 30yrs)	$475,110	$5,685,820	$6,471,000	$6,835,450	$13,065,000	$27,333,630	$80,438,180
State Acceptance	To be addressed following public comment				To be addressed following public comment		
Community Acceptance	To be addressed following public comment				To be addressed following public comment		

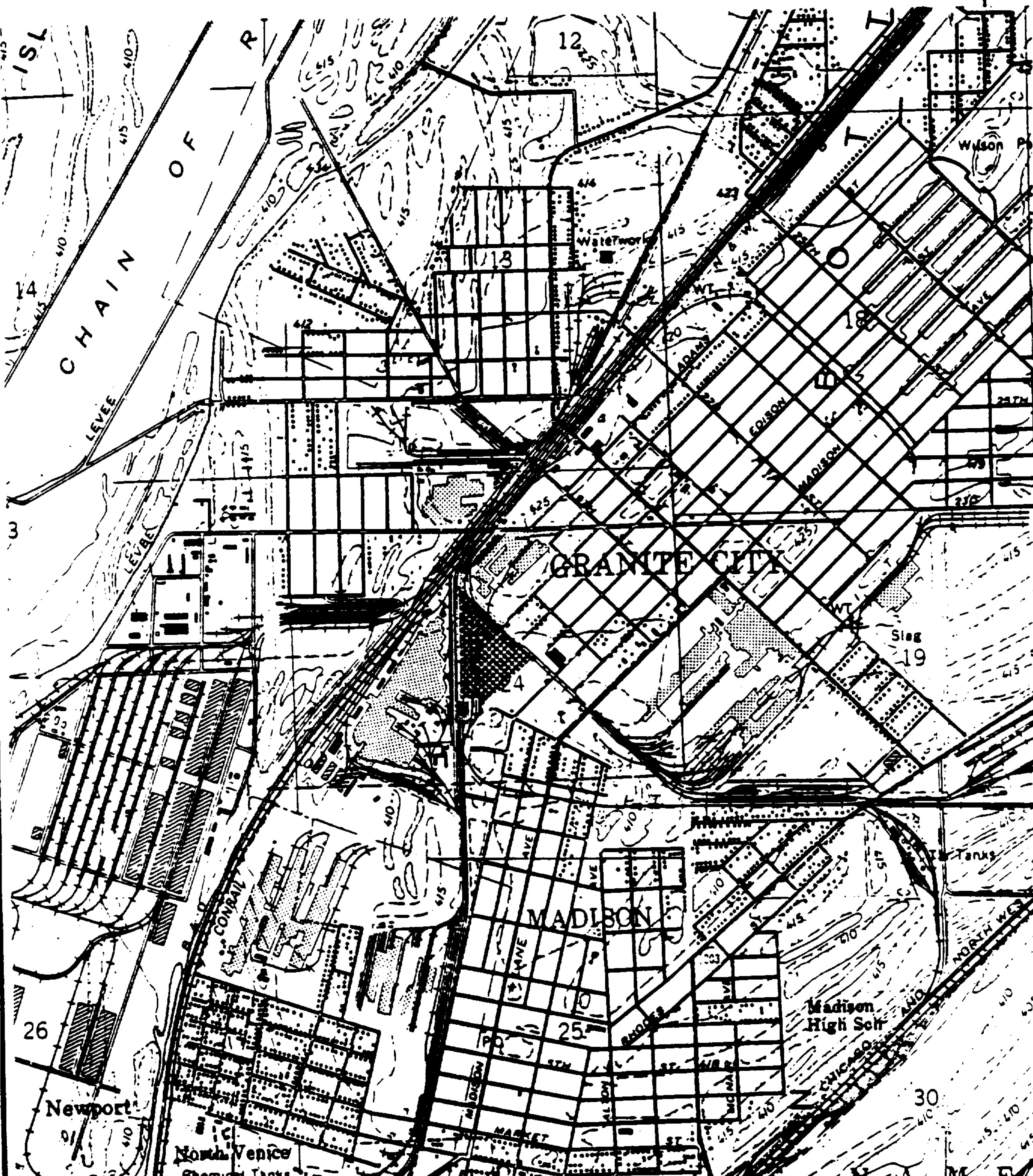
TABLE 21 - EVALUATION AND COMPARISON OF ALTERNATIVES

Assessment Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
	Deed and access restrictions at Taracorp Pile, Eagle Park, Area 1.	Recycle contained drosses. Multi-media cap at Taracorp Pile; vegetated clay cap at Eagle Park; asphalt or sod cover at Venice Alloys and Areas 1, 2, 3	Recycle contained drosses. Multi-media cap at Taracorp Pile; excavate and restore Eagle Park, Venice Alloys, Areas 1, 2; asphalt or sod cover Area 3	Recycle contained drosses. Multi-media cap at Taracorp Pile; excavate and restore Eagle Park, Venice Alloys Areas 1, 2, 3	Recycle contained drosses. Multimedia cap at Taracorp Pile with supplemental bottom liner. Excavate and restore Eagle Park, Venice Alloys, Areas 1, 2, 3.	Recycle contained drosses. Multimedia cap at Taracorp Pile with supplemental bottom liner. Segregate and recover plastic, lead. Excavate and restore Eagle Park, Venice Alloys, Areas 1, 2, 3.	Recycle contained drosses. Excavate Taracorp Pile, Venice Alloys, Eagle Park, Areas 1, 2 and dispose in RCRA landfill. Excavate Area 3 and dispose in non-RCRA landfill. Restore all areas. Segregate and recover lead, plastic from Taracorp Pile
Overall protection of human health and the environment							
- How risks are eliminated, reduced, or controlled	Institutional controls limit risk of direct contact at Taracorp pile, Eagle Park, Area 1. No risk reduction at Venice Alloys, Areas 2 and 3.	Multimedia cap eliminates risk of direct contact and migration of contamination at Taracorp Pile; a vegetated clay cap eliminates these risks at Eagle Park. Sod / asphalt cover reduces risk at Areas 1, 2, 3 and Venice Alloys.	Multimedia cap eliminates risk of direct contact and migration of contamination at Taracorp Pile. Contaminants excavated and removed from Eagle Park, Venice Alloys, Areas 1 and 2. Sod / asphalt cover reduces risks at Area 3.	Multimedia cap eliminates risk of direct contact and migration of contamination at Taracorp Pile. Contaminants excavated and removed from Eagle Park, Venice Alloys, Areas 1, 2, and 3.	Multimedia cap, bottom liner eliminates risk of direct contact, migration of contaminants at Taracorp Pile. Contaminants excavated and removed from Eagle Park, Venice Alloys, Areas 1, 2, and 3.	Multimedia cap, bottom liner eliminates risk of direct contact, migration of contaminants at Taracorp Pile. Contaminants excavated and removed from Eagle Park, Venice Alloys, Areas 1, 2, and 3. Minimal reduction in volume achieved by segregation, recycling.	Excavation, disposal in RCRA landfill eliminates risk of direct contact, migration of contaminants. Minimal reduction in volume achieved by segregation, recycling.
Compliance with ARARs							
- Compliance with ARARs	All ARARs will be met.	All ARARs will be met.	All ARARs will be met.	All ARARs will be met.	All ARARs will be met.	All ARARs will be met.	All ARARs will be met.
Long Term Effectiveness							
- Magnitude of residual risk	Risk of human exposure at Venice Alloys, Areas 2, 3 remains; some reduction in exposure risk at Taracorp Pile, Eagle Park, Area 1. Risk of airborne migration of contaminants from all areas.	Risk of human exposure, air-borne contamination eliminated at Taracorp Pile. Elsewhere, these risks eliminated upon completion of remedial activity	Risk of human exposure, air-borne contamination eliminated, except at Area 3, where remaining risk minimal.	Risk of human exposure, air-borne contamination eliminated.	Risk of human exposure, air-borne contamination eliminated.	Risk of human exposure, air-borne contamination eliminated.	Risk of human exposure, air-borne contamination eliminate
- Adequacy of controls	No controls at Venice Alloys, Areas 2, 3.	Multimedia cap proven effective, some maintenance required. Covers in remote areas effective, however, maintenance can not be insured.	Multimedia cap proven effective, some maintenance required. Excavation and restoration in remote areas completely adequate.	Multimedia cap proven effective, some maintenance required. Excavation and restoration in remote areas completely adequate.	Multimedia cap, bottom liner proven effective, some maintenance required. Excavation and restoration in remote areas completely adequate.	Multimedia cap, bottom liner proven effective, some maintenance required. Excavation and restoration in remote areas completely adequate.	Excavation and disposal in RC landfill proven effective.
- Reliability of controls	Fencing will require repair.	Cap failure improbable with proper O&M. For remote areas, asphalt cover failure improbable, sod cover failure possible, but immediate risk mitigated by 3" topsoil.	Cap failure improbable with proper O&M. Risk eliminated in remote areas. Risk at Area 3 minimal should cover fail.	Cap failure improbable with proper O&M. Risk eliminated in remote areas.	Cap failure improbable with proper O&M. Risk eliminated in remote areas.	Cap failure improbable with proper O&M. Risk eliminated in remote areas.	RCRA landfill reliable.
Reduction of Toxicity, Mobility, or Volume	No reduction of toxicity, mobility, or volume.	Mobility of contaminants significantly reduced at Taracorp Pile, Eagle Park, remote areas with asphalt cover. Mobility limited at areas with sod cover. Reduction in toxicity and volume achieved by recycling drosses.	Mobility of contaminants significantly reduced at all areas, except sodded portions of Area 3, where mobility reduced. Reduction in toxicity and volume achieved by recycling drosses.	Mobility of contaminants significantly reduced at all areas. Reduction in toxicity and volume achieved by recycling drosses.	Mobility of contaminants significantly reduced at all areas. Reduction in toxicity and volume achieved by recycling contained drosses.	Mobility of contaminants significantly reduced at all areas. Minimal reduction in volume (10%) achieved by segregation and recovery at Taracorp Pile. Reduction in toxicity and volume achieved by recycling contained drosses.	Mobility of contaminants significantly reduced at all areas. Minimal reduction in volume (10%) achieved by segregation and recovery at Taracorp Pile. Reduction in toxicity and volume achieved by recycling contained drosses.
Short Term Effectiveness							
- Time until protection is achieved (after ROD signing)	6 - 12 months	1 - 2 years	1 - 2 years	1 - 2 years	3 - 4 years	5 - 6 years	5 - 6 years
- Protection of community during remedial actions	No short term impact.	No short term impact.	Dust generated by excavation at remote areas would require monitoring and control.	Dust generated by excavation at remote areas would require monitoring and control.	Dust generated by excavations at remote areas, Taracorp Pile would require monitoring and control.	Dust generated by excavation at remote areas, Taracorp Pile would require monitoring and control.	Dust generated by excavation at remote areas, Taracorp Pile would require monitoring and control.
- Protection of workers during remedial actions	No short term impact.	No short term impact.	Dust generated by excavation at remote areas would require monitoring and control.	Dust generated by excavation at remote areas would require monitoring and control	Dust generated by excavations at remote areas, Taracorp Pile would require monitoring and control.	Dust generated by excavation at remote areas, Taracorp Pile would require monitoring and control. Significant worker exposure risk during segregation and recovery operations.	Dust generated by excavation at remote areas, Taracorp Pile would require monitoring and control. Significant worker exposure risk during segrega and recovery operations.
- Protection of environment during remedial actions	No short term impact.	No short term impact.	Dust generated by excavation at remote areas would require monitoring and control.	Dust generated by excavation at remote areas would require monitoring and control.	Dust generated by excavations at remote areas, Taracorp Pile would require monitoring and control. Excavation at Taracorp Pile exposes wastes to precipitation.	Dust generated by excavation at remote areas, Taracorp Pile would require monitoring and control. Excavation at Taracorp Pile exposes wastes to precipitation.	Dust generated by excavation at remote areas, Taracorp Pile would require monitoring and control. Excavation at Taracorp Pile exposes wastes to precipitation.

NL INDUSTRIES
GRANITE CITY SITE
GRANITE CITY, ILLINOIS

LOCATION MAP

N



- PROJECT SITE

NOTE: MAP ADAPTED FROM U.S.G.S. GRANITE CITY QUADRANGLE

QUADRANGLE LOCATION

SCALE

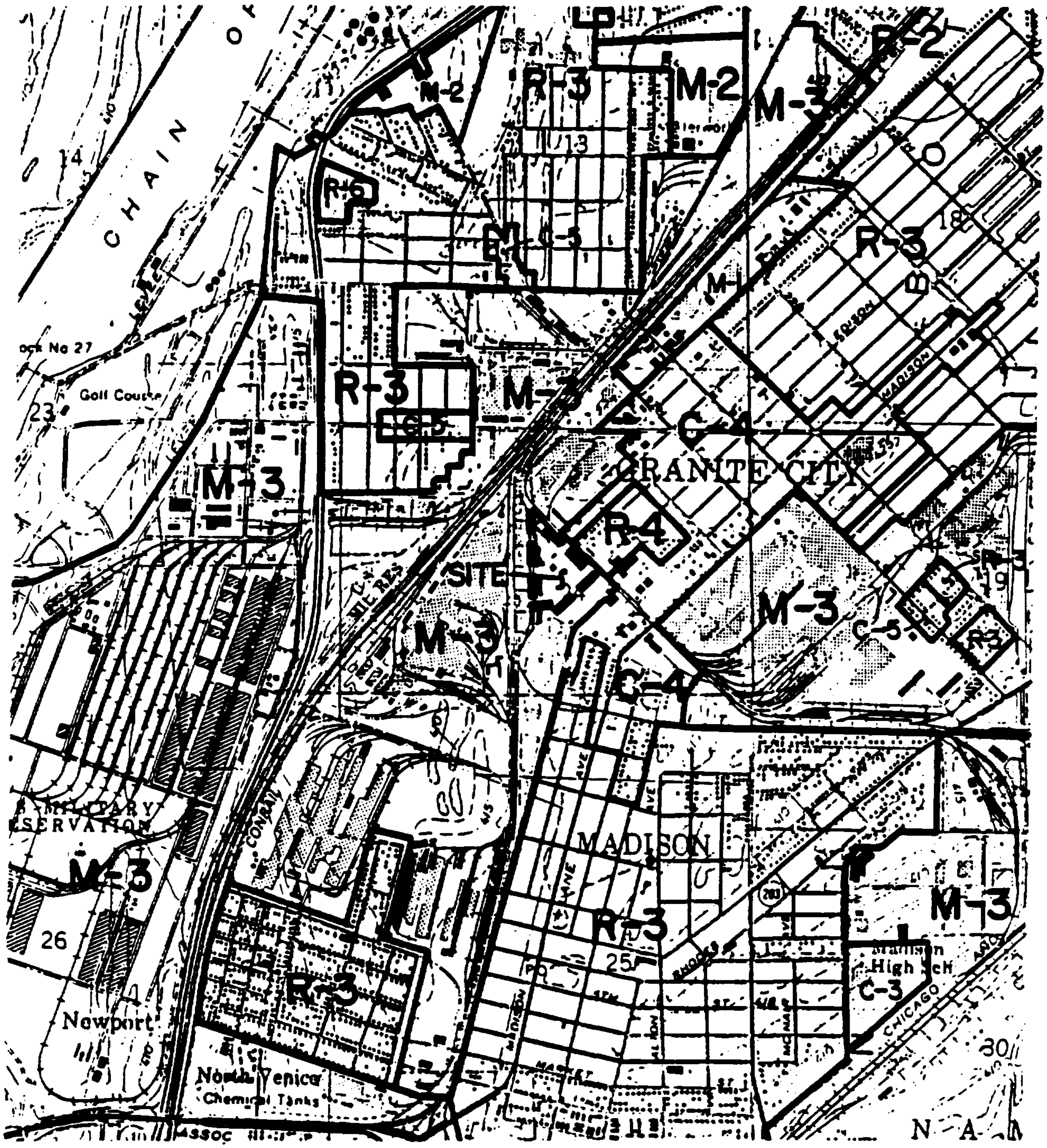
0 1

MILES

O'BRIEN & GERE ENGINEERS, INC

NL INDUSTRIES GRANITE CITY SITE

LAND USE MAP



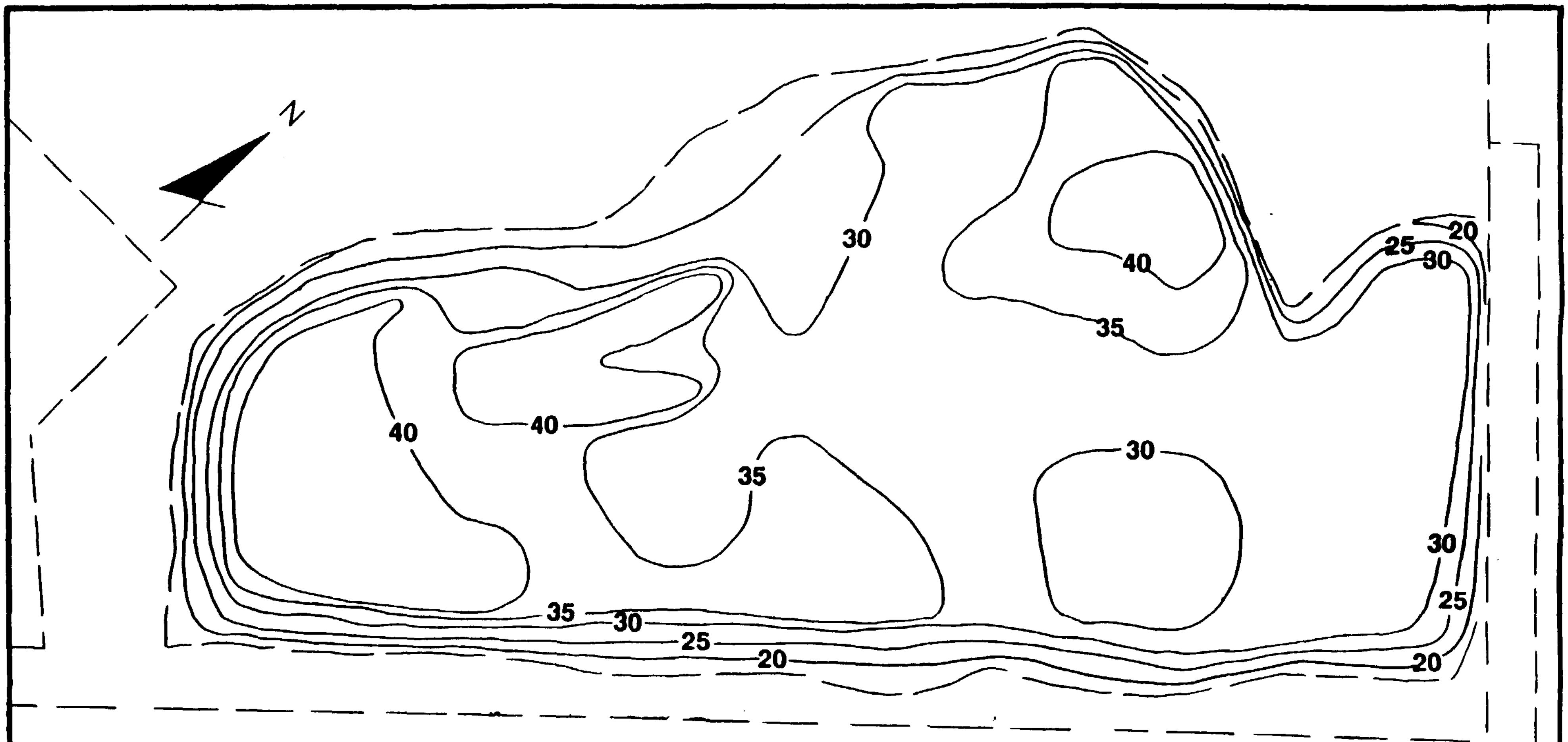
LEGEND

R-1	SINGLE FAMILY RESIDENCE	C-1	OFFICE COMMERCIAL
R-2	SINGLE FAMILY RESIDENCE	C-2	NEIGHBORHOOD COMMERCIAL
R-3	SINGLE FAMILY RESIDENCE	C-3	COMMUNITY SERVICE
R-4	TWO FAMILY RESIDENCE	C-4	CENTRAL BUSINESS COMMERCIAL
R-5	MULTI-FAMILY RESIDENCE	C-5	HIGHWAY COMMERCIAL
R-6	MOBILE HOME RESIDENCE	C-6	PLANNED COMMERCIAL
M-1	WAREHOUSE INDUSTRIAL	M-3	HEAVY INDUSTRIAL
M-2	LIGHT INDUSTRIAL	M-4	PLANNED INDUSTRIAL

SCALE IN MILES

0 1/4 1/2

O'BRIEN & GERE ENGINEERS, INC.



CURRENT CONTOURS

GENERAL NOTES

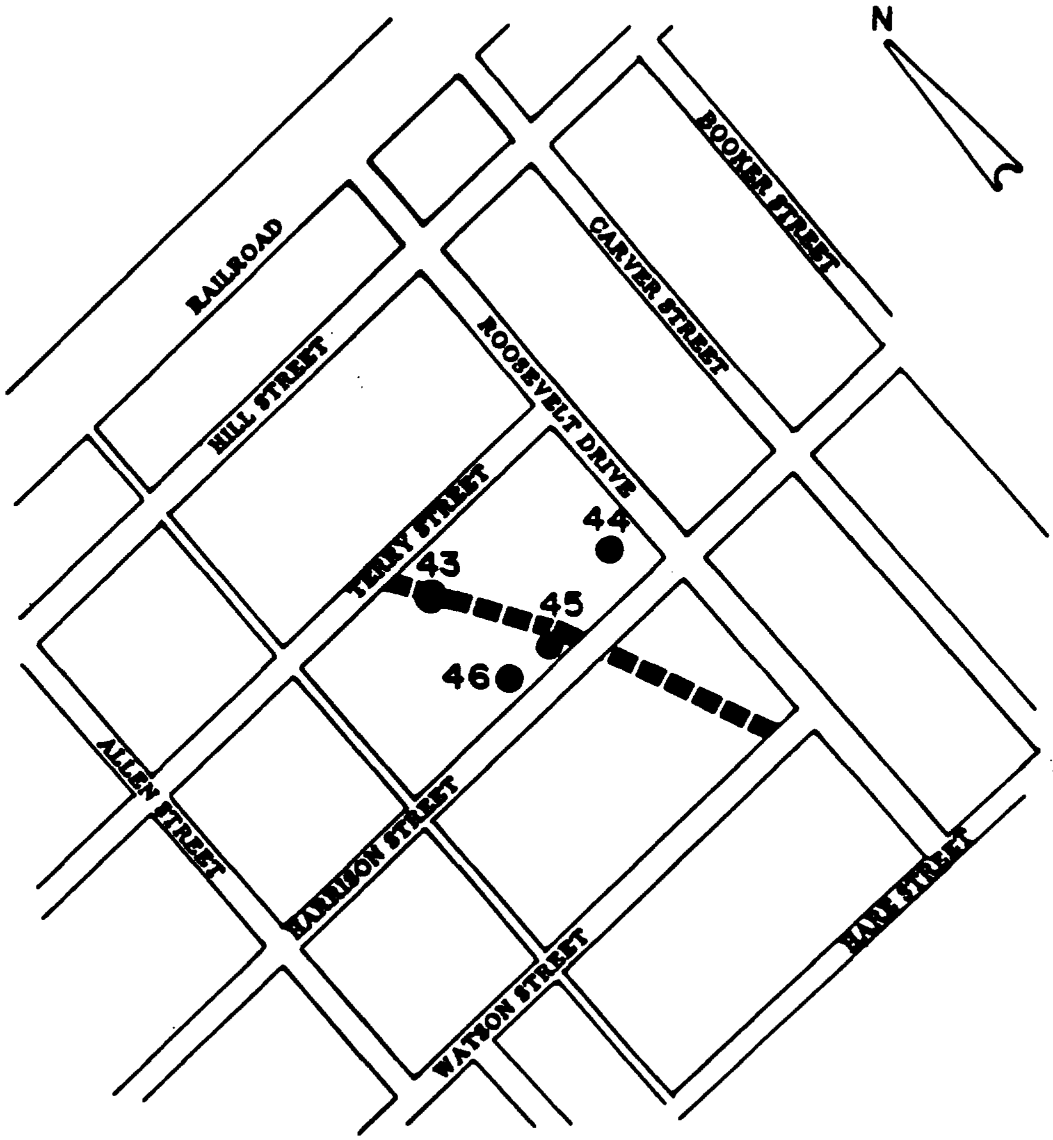
1. BENCH MARK - TOP RIM MANHOLE LOCATED AT THE INTERSECTION OF DELMAR AVE. & 16TH ST. (ELEV. 418.42).

2. ADD 400.0 TO SPOT ELEVATIONS SHOWN TO OBTAIN MEAN SEA LEVEL DATUM.

3. EXISTING GRADE SURROUNDING WASTE PILE VARIES FROM 416.0 TO 423.3 FEET.

O'BRIEN & GERE ENGINEERS, INC

APPROXIMATE SCALE: 1" = 75 FEET



REMOTE FILL AREA

EAGLE PARK ACRES

LEGEND

● SOIL SAMPLE LOCATION

■■■ APPROXIMATE LOCATION OF DITCH

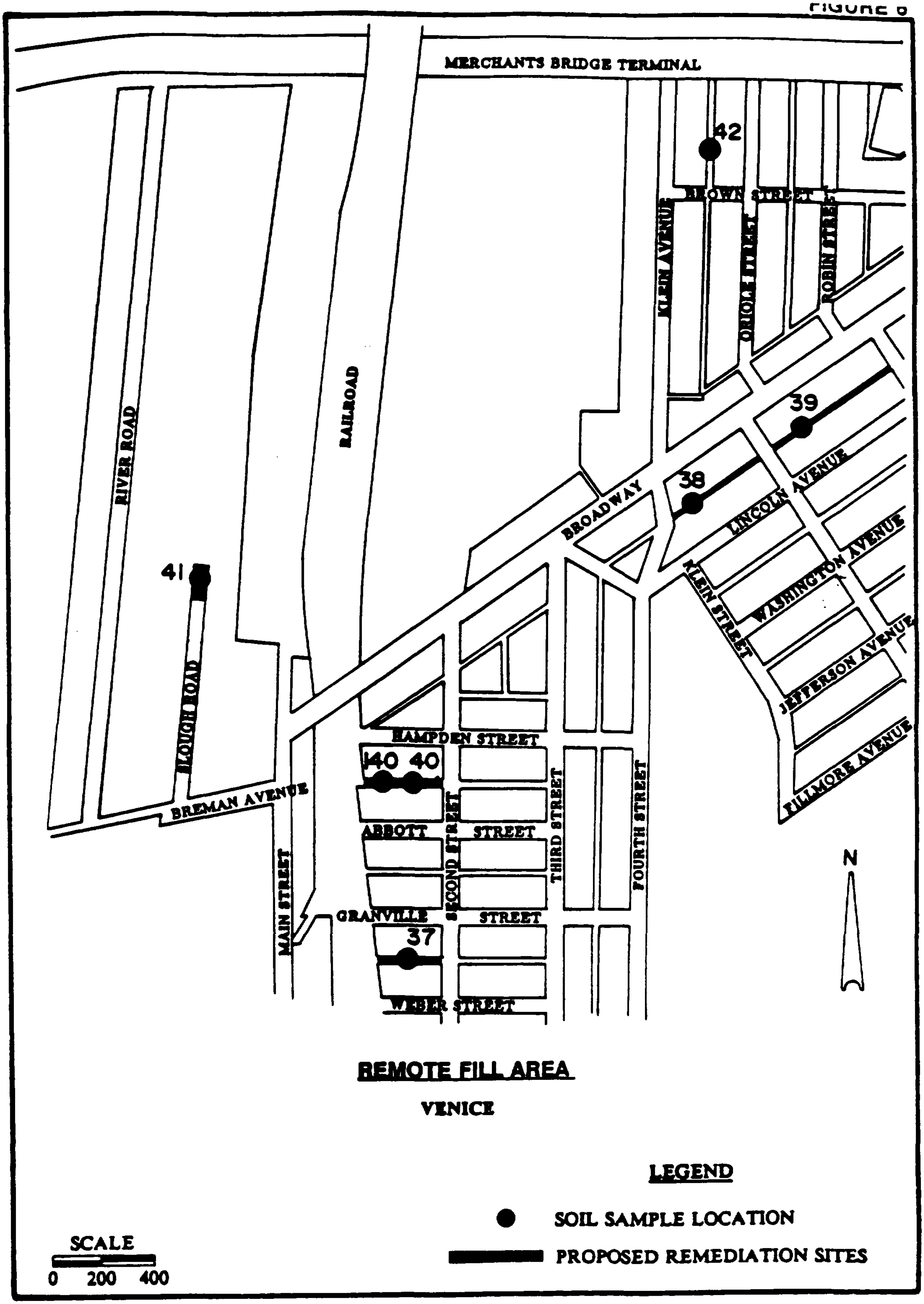
SCALE

0 200 400

063397

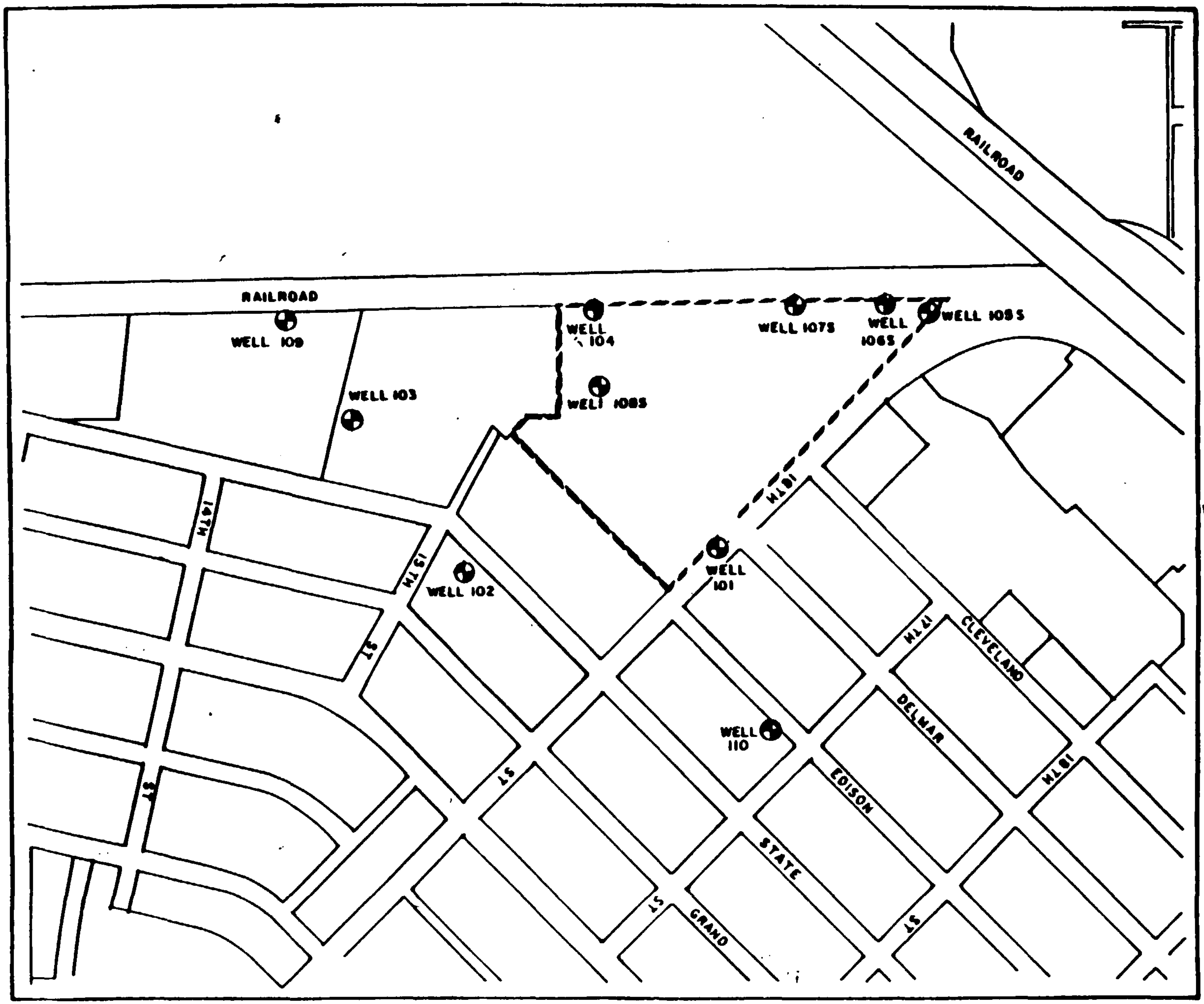
O'BRIEN & GERE ENGINEERS, INC.

FIGURE 6



063597

O'BRIEN & GERE ENGINEERS, INC.



NL INDUSTRIES
GRANITE CITY SITE
GRANITE CITY, ILLINOIS

WELL LOCATION MAP

LEGEND

WELL 101 GROUNDWATER MONITO[R] WELL & GROUNDWATER

SITE PERIMETER

SCALE

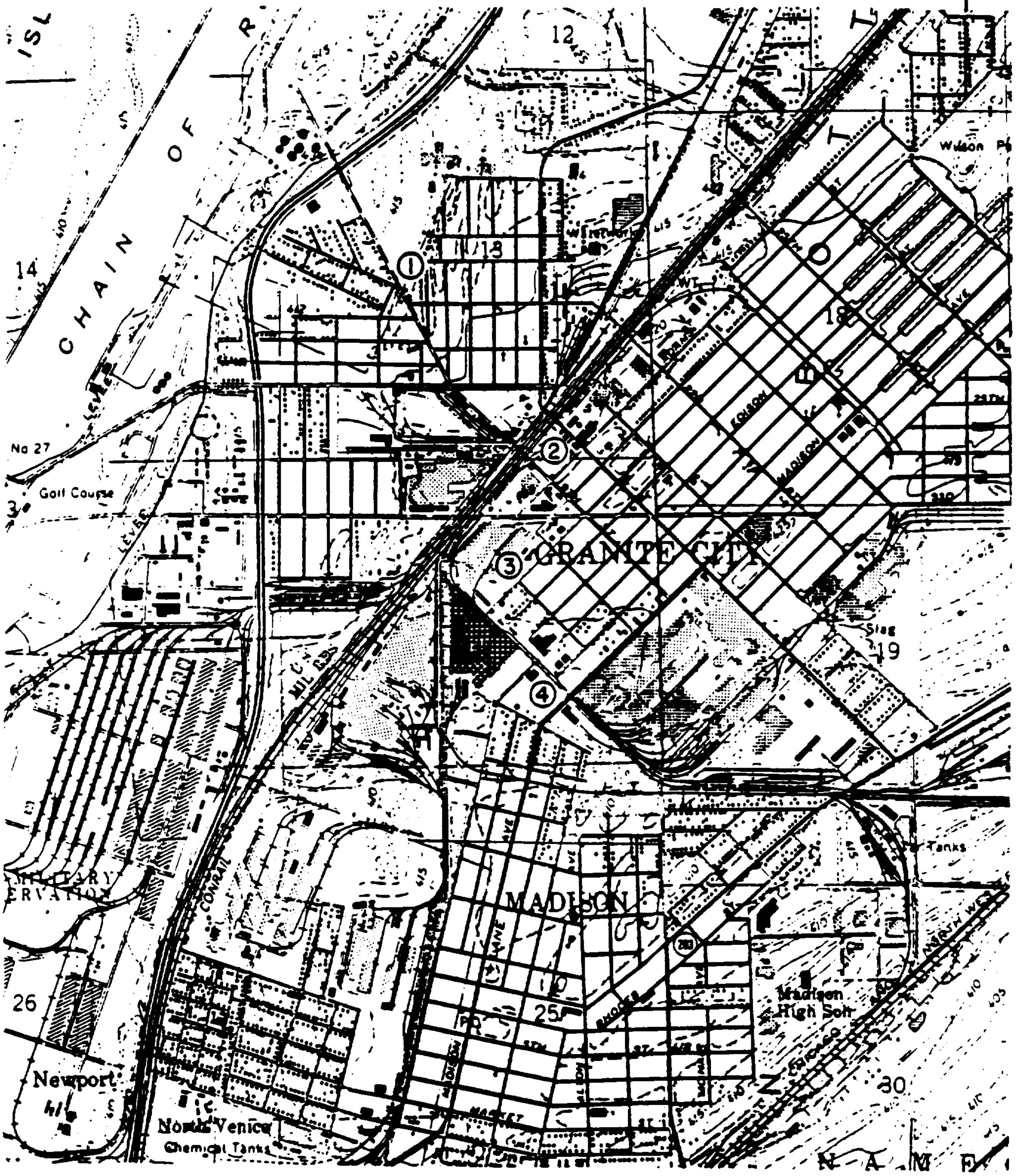
300 0 300

FEET

O'BRIEN & GERE

NL INDUSTRIES
GRANITE CITY SITE
GRANITE CITY, ILLINOIS

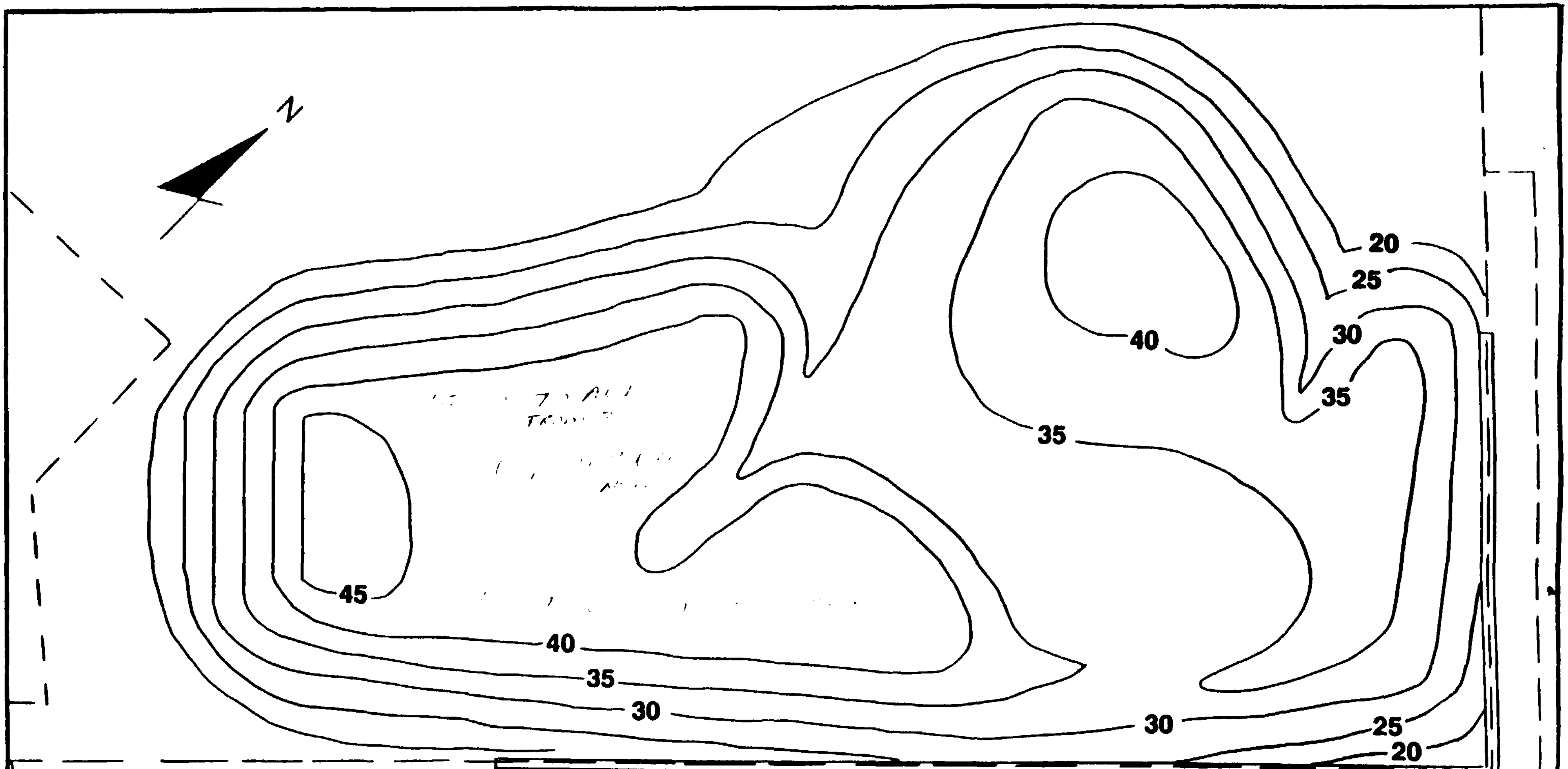
IEPA AMBIENT AIR MONITORING LOCATIONS



- PROJECT SITE
① - ROOSEVELT AND ROCK ROADS
② - 20 th AND ADAMS
③ - 1733 CLEVELAND
④ - 16 th AND MADISON

SCALE
0 1
MILES

O'BRIEN & GERE ENGINEERS INC



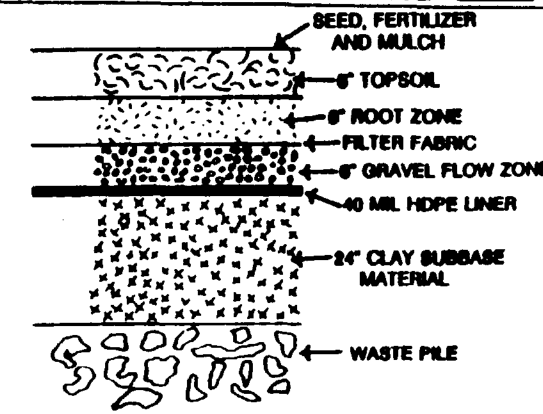
PROPOSED CONTOURS

GENERAL NOTES

1. BENCH MARK - TOP RIM MANHOLE LOCATED AT THE INTERSECTION OF DELMAR AVE. & 16TH ST. (ELEV. 418.42).

2. ADD 400.0 TO SPOT ELEVATIONS SHOWN TO OBTAIN MEAN SEA LEVEL DATUM.

3. EXISTING GRADE SURROUNDING WASTE PILE VARIES FROM 416.0 TO 423.3 FEET.



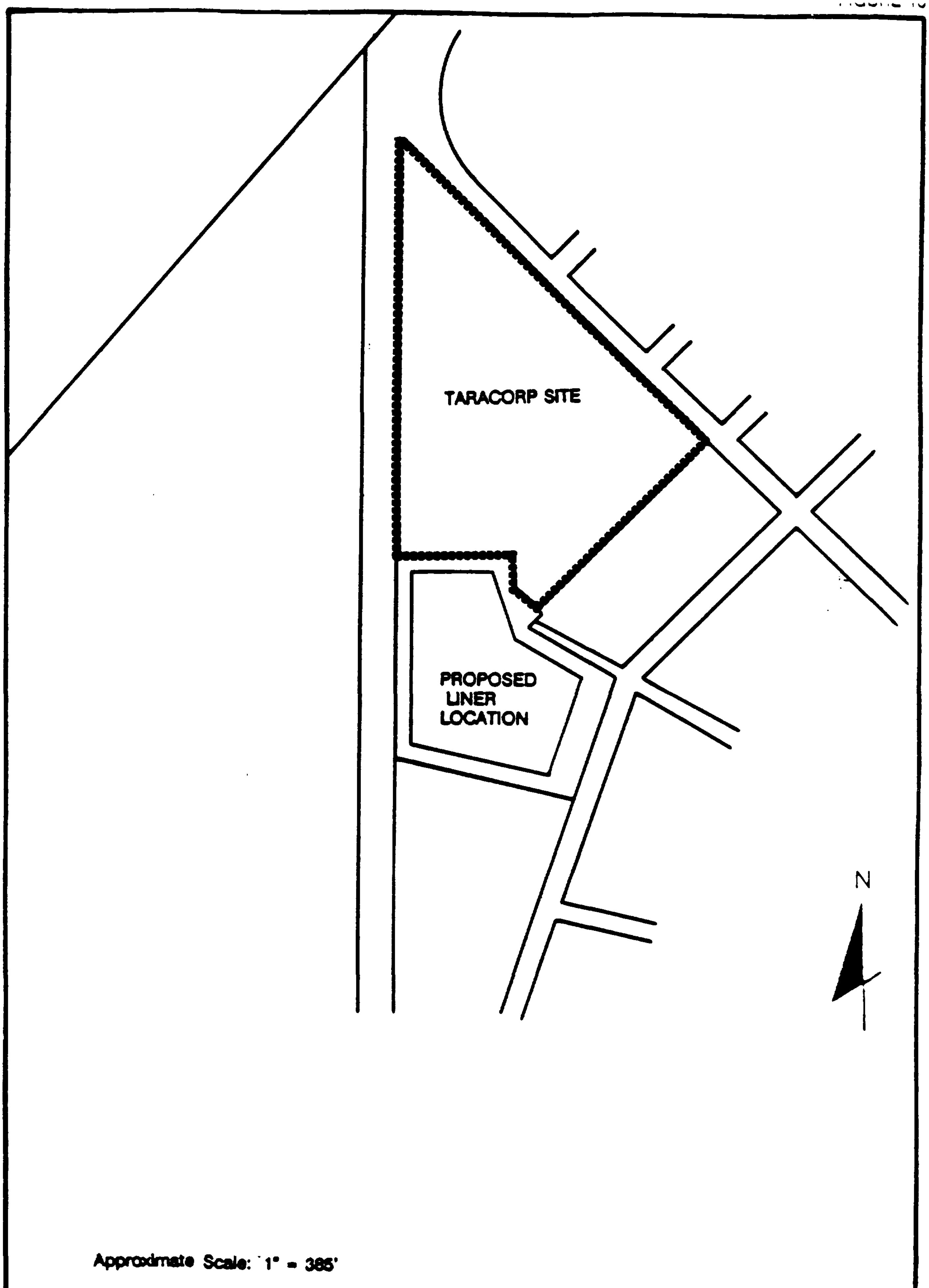
LANDFILL CAP DETAIL

NO SCALE

APPROXIMATE SCALE: 1" = 75 FEET

O'BRIEN & GERE ENGINEERS, INC.

FIGURE 9



O'BRIEN & GERE
ENGINEERS, INC.

Appendices

APPENDIX A

Evaluation of Percolation through Proposed Multimedia Cap using the HELP MODEL

HELP MODEL

The Hydrological Evaluation of Landfill Performance (HELP) program was developed by the U.S. Army Engineer Waterways Experiment Station at Vicksburg, MS to facilitate rapid, economical estimations of water movement across, into, through, and out of landfills. The program is applicable for evaluation of open, partially closed, and fully closed sites by both designers and permit writers. (Adapted from forward, "The Hydrological Evaluation of Landfill Performance (HELP) Model", U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, June 1984).

Pages A-1 through A-3 present the assumptions and results for a HELP Model simulation of percolation through the proposed multimedia cap, which would consist of 24 inches of clay, an impermeable membrane, a 6-inch drainage layer, a 6-inch root zone, and 6 inches of topsoil. Climatic conditions were generated by the model for East St. Louis, Illinois, a city adjacent to Granite City. The results indicate that approximately 2 cubic feet of precipitation per year would be expected to percolate through the 175,000 square feet of multimedia cap. This compares to approximately 254,000 cubic feet per year predicted to currently percolate through the waste piles (Pages A-4 through A-6).

COMPARISON OF MODEL RESULTS TO RCRA SUBTITLE C REQUIREMENTS

RCRA Subtitle C places the following performance criteria on final covers:

1. Provide long-term minimization of migration of liquids through the closed landfill;
2. Function with minimum maintenance;

3. Promote drainage and minimize erosion or abrasion of the cover;

4. Accommodate settling and subsidence so that the cover's integrity is maintained; and,

4. Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

The proposed multimedia cap would be constructed to meet all these requirements. The HELP model demonstrated long-term minimization of migration of liquids through capped waste piles (OBJECTIVE 1). Cap maintenance would be limited to mowing, periodic inspection, and maintenance of the vegetative cover (OBJECTIVE 2).

The cap would be designed to minimize erosion or abrasion of the cover (OBJECTIVE 3). The waste piles have been in place for a considerable period of time. Cover settling and subsidence would not be expected (OBJECTIVE 4). The cover, as designed, would have a permeability less than the natural subsoils present (OBJECTIVE 5).

****
****

JRACORP PILE
'ANITE CITY, ILLINOIS
PROPOSED COVER ASSESSMENT

****
****

FAIR GRASS

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	6.00 INCHES
POROSITY	=	0.4730 VOL/VOL
FIELD CAPACITY	=	0.2224 VOL/VOL
WILTING POINT	=	0.1045 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2642 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.0015600000042 CM/SEC

LAYER 2

VERTICAL PERCOLATION LAYER

THICKNESS	=	6.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1314 VOL/VOL
WILTING POINT	=	0.0581 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1540 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.0010000000475 CM/SEC

LAYER 3

LATERAL DRAINAGE LAYER

THICKNESS	=	6.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.0835 VOL/VOL
WILTING POINT	=	0.0327 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1362 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.0031000000890 CM/SEC
SLOPE	=	25.00 PERCENT
DRAINAGE LENGTH	=	300.0 FEET

LAYER 4

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4300 VOL/VOL
FIELD CAPACITY	=	0.3667 VOL/VOL
WILTING POINT	=	0.2804 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.0000001000000 CM/SEC
LINER LEAKAGE FRACTION	=	0.00010000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	74.26
TOTAL AREA OF COVER	=	175000. SQ FT

```
EVAPORATIVE ZONE DEPTH              =      20.00 INCHES
JPPER LIMIT VEG. STORAGE            =      8.3220 INCHES
INITIAL VEG. STORAGE                =      3.3290 INCHES
        SOIL WATER CONTENT INITIALIZED BY PROGRAM.
```

CLIMATOLOGICAL DATA

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR E. ST. LOUIS ILLINOIS

```
MAXIMUM LEAF AREA INDEX                = 2.00
START OF GROWING SEASON (JULIAN DATE)  =  109
END OF GROWING SEASON (JULIAN DATE)    =  296
```

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

AN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
29.80	34.60	43.80	56.20	65.20	74.10
77.70	75.70	69.00	57.60	44.90	35.00

* ***

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 74 THROUGH 74

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
RECIPITATION						
TOTALS	3.51	4.17	2.58	2.40	5.90	3.45
	0.90	5.05	2.50	1.51	3.15	1.71
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
UNOFF						
TOTALS	0.000	0.027	0.000	0.000	0.079	0.000
	0.000	0.053	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.116	1.733	2.957	2.709	3.331	6.102
	0.814	2.151	3.585	2.020	1.784	0.939
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
ATERAL DRAINAGE FROM LAYER 3						
TOTALS	0.8524	1.7796	1.9538	0.6642	0.2658	0.7685
	0.0000	0.0002	0.3765	0.1564	0.2707	0.3437
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

* ***

* ***

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 74 THROUGH 74

	(INCHES)		(CU. FT.)	PERCENT
RECIPITATION	36.83	(0.000)	537104.	100.00
RUNOFF	0.159	(0.000)	2322.	0.43

VAPOTRANSPIRATION	29.241	(0.000)	426429.	79.39
LATERAL DRAINAGE FROM LAYER 3	7.4318	(0.0000)	108381.	20.18
PERCOLATION FROM LAYER 4	0.0001	(0.0000)	2.	0.00
CHANGE IN WATER STORAGE	-0.002	(0.000)	-28.	-0.01

* **

* **

PEAK DAILY VALUES FOR YEARS 74 THROUGH 74

	(INCHES)	(CU. FT.)
PRECIPITATION	2.63	38354.2
RUNOFF	0.079	1146.5
LATERAL DRAINAGE FROM LAYER 3	0.0936	1364.3
PERCOLATION FROM LAYER 4	0.0000	0.0
HEAD ON LAYER 4	8.5	
SNOW WATER	0.33	4812.5

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3500

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0651

****

****

FINAL WATER STORAGE AT END OF YEAR 74

LAYER	(INCHES)	(VOL/VOL)
1	1.79	0.2991
2	0.92	0.1541
3	0.82	0.1361
4	10.32	0.4300
SNOW WATER	0.00	

****

* **

```
******************************************************************************
******************************************************************************

  RACORP SITE
 _ANITE CITY ILLINOIS
 CURRENT CONDITIONS

******************************************************************************
******************************************************************************


                              LAYER  1
                              --------

                     VERTICAL PERCOLATION LAYER
  THICKNESS                                 =      24.00 INCHES
  POROSITY                                  =       0.4170 VOL/VOL
  FIELD CAPACITY                            =       0.0457 VOL/VOL
  WILTING POINT                             =       0.0200 VOL/VOL
  INITIAL SOIL WATER CONTENT                =       0.0845 VOL/VOL
  SATURATED HYDRAULIC CONDUCTIVITY          =       0.0099999997765 CM/SEC


                       GENERAL SIMULATION DATA
                       -----------------------

  SCS RUNOFF CURVE NUMBER                   =      72.60
  TOTAL AREA OF COVER                       =  175000. SQ FT
  EVAPORATIVE ZONE DEPTH                    =       8.00 INCHES
  POTENTIAL RUNOFF FRACTION                 =       0.000000
  UPPER LIMIT VEG. STORAGE                  =       3.3360 INCHES
  INITIAL VEG. STORAGE                      =       0.9089 INCHES
            SOIL WATER CONTENT INITIALIZED BY PROGRAM.


                        CLIMATOLOGICAL DATA
                        -------------------

  DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
  SOLAR RADIATION FOR      E. ST. LOUIS        ILLINOIS


  MAXIMUM LEAF AREA INDEX                     = 0.00
  START OF GROWING SEASON (JULIAN DATE)       =  109
  END OF GROWING SEASON (JULIAN DATE)         =  296

        NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

 JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
 -------     -------     -------     -------     -------     -------

  29.80       34.60       43.80       56.20       65.20       74.10
  77.70       75.70       69.00       57.60       44.90       35.00

******************************************************************************

                   MONTHLY TOTALS FOR YEAR   74
 ----------------------------------------------------------------------------

                           JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                           ------- ------- ------- ------- ------- -------

  PRECIPITATION (INCHES)    3.51    4.17    2.58    2.40    5.90    3.45
                            0.90    5.05    2.50    1.51    3.15    1.71

 RUNOFF (INCHES)            0.000   0.000   0.000   0.000   0.000   0.000
                            0.000   0.000   0.000   0.000   0.000   0.000

 EVAPOTRANSPIRATION         1.289   1.355   2.444   2.246   2.620   2.673
     (INCHES)               0.880   1.359   1.685   0.795   1.212   0.886

  PERCOLATION FROM          2.4354  2.9830  0.5712  0.2792  1.6455  2.3049
```

AYER 1 (INCHES)	0.2184	2.1029	1.4629	1.4324	1.6777	0.2733

ANNUAL TOTALS FOR YEAR 74

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	36.83	537104.	100.00
UNOFF	0.000	0.	0.00
EVAPOTRANSPIRATION	19.443	283543.	52.79
PERCOLATION FROM LAYER 1	17.3867	253556.	47.21
HANGE IN WATER STORAGE	0.000	5.	0.00
SOIL WATER AT START OF YEAR	2.30	33566.	
OIL WATER AT END OF YEAR	2.30	33571.	
SNOW WATER AT START OF YEAR	0.00	0.	
SNOW WATER AT END OF YEAR	0.00	0.	
NNUAL WATER BUDGET BALANCE	0.00	0.	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 74 THROUGH 74

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.51	4.17	2.58	2.40	5.90	3.45
	0.90	5.05	2.50	1.51	3.15	1.71
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
UNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.289	1.355	2.444	2.246	2.620	2.673
	0.880	1.359	1.685	0.795	1.212	0.886
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
PERCOLATION FROM LAYER 1						
TOTALS	2.4354	2.9830	0.5712	0.2792	1.6455	2.3049
	0.2184	2.1029	1.4629	1.4324	1.6777	0.2733
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

VERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 74 THROUGH 74

	(INCHES)		(CU. FT.)	PERCENT
PRECIPITATION	36.83	(0.000)	537104.	100.00

RUNOFF	0.000	(0.000)	0.	0.00
EVAPOTRANSPIRATION	19.443	(0.000)	283543.	52.79
PERCOLATION FROM LAYER 1	17.3867	(0.0000)	253556.	47.21
CHANGE IN WATER STORAGE	0.000	(0.000)	5.	0.00

****

****

PEAK DAILY VALUES FOR YEARS 74 THROUGH 74

	(INCHES)	(CU. FT.)
PRECIPITATION	2.63	38354.2
RUNOFF	0.000	0.0
PERCOLATION FROM LAYER 1	1.1286	16458.2
SNOW WATER	0.33	4812.5

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.1719
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0132

****

****

FINAL WATER STORAGE AT END OF YEAR 74

LAYER	(INCHES)	(VOL/VOL)
1	2.30	0.0959
SNOW WATER	0.00	

****
****

Exhibits

These alternatives include alternatives requiring no long-term management of residuals (Alternative 10A) and alternatives involving treatment as a principal element (Alternatives 2C, 10A, 10B, 10C, and 21). In addition, containment alternatives (Alternatives 2A, 2B, 2C, 8A, 8B, 10B, 10C, 21, and 25) are included, as well as a No-Action Alternative (Alternative 1). These alternatives were all carried through the detailed evaluation process.

Nine factors were considered in evaluating the Final Candidate Alternatives: long-term effectiveness and permanence; reduction in toxicity, mobility or volume; short-term effectiveness; implementability; cost; overall protection of human health and the environment; compliance with applicable or revelant and appropriate requirements (ARARs); state acceptance; and community acceptance. The first five factors were considered in detail. Analysis of the alternatives in terms of these factors consisted of balancing the various technical elements involved in completing remediation. The final two factors - state and community acceptance - were evaluated only on the basis of available information. Thorough consideration of these two factors cannot occur until after the public review and comment period on the RI/FS and Proposed Plan. The other two factors - overall protection of human health and the environment and compliance with ARARS - were considered last, since their development requires information from the previous evaluations.

As part of the evaluation of the Final Candidate Alternatives, several engineering studies were performed to determine whether the SARA preference for treatment could be met. The engineering studies represented one category (technical feasibility) of one factor used to evaluate the Final Candidate Alternatives. A bench-scale soil stabilization study was performed by Weston Services, Inc. Weston used several different reagents to determine the applicability of the soil stabilization technique to Gould site soils and lake sediments. The results showed that admixtures of Portland cement, cement kiln dust, and lime kiln dust with the soil and sediment at specific increments improved the consistency and structural stability of the soils and sediments, and also reduced the leachability of the contaminated materials to levels generally below hazardous waste designation levels.

Three battery casing separation tests were performed on site materials. One test was performed on equipment manufactured by MA Industries, Inc. and the other two on equipment manufactured by Poly-Cycle Industries, Inc. To conduct each test, approximately 20 tons of representative material was excavated from the site and shipped to locations where equipment manufactured by the two companies is in use. In the case of MA Industries, the test was run on equipment operated by Ace Battery Company of Indianapolis, Indiana. The tests of Poly-Cycle equipment were run at the Poly-Cycle plant in Jacksonville, Texas. The equipment manufactured by the two companies is similar; however MA Industries markets its equipment to battery breaking operations, while Poly-Cycle's primary interest is in developing markets for the separated battery components. For each firm, the process is designed to apply to spent batteries, not to battery components mixed with dirt and mud.

The results for the tests were similar, but with different problems. During the Ace Battery test, extremely heavy foaming complicated the separation process and reduced its efficiency. During the Poly-Cycle tests, various equipment problems affected the efficiency of metallic lead/ebonite separation. Reasonable physical separation of the plastic and ebonite components with some equipment modifications appears to be possible, although the post-separation degree of metallic lead contamination of ebonite is so high that recycling is doubtful. Of more importance, though, is the amount of lead contained in the interstices of the plastic and the ebonite. After separation, both components fail the TCLP test for lead. Ebonite fails badly even after washing with hydrochloric acid and deionized water.

During the evaluation of alternatives, similar tests were run independently by researchers working on materials from the United Scrap Lead Superfund site near Troy, Ohio. Researchers there performed bench-scale tests using various solutions and mechanical cleaning steps to determine the amenability of lead to be removed from the ebonite material. While no prediction can be made by extrapolating the laboratory results to field work, it appears that the process requirements would be of considerable scope and have significant environmental concerns. The researchers conclude that more work is required before the laboratory results could be applied to any field-scale unit. The results achieved to date by NL Industries, Inc. and Gould Inc. in laboratory and field tests lead to the same conclusion.

Results reported to date show that great difficulty is encountered in attempting to reduce the interstitial lead content of the ebonite. Researchers have tried various combinations of separation steps, including physical, mechanical, and chemical steps, in addition to hand-separation at the outset. Even if laboratory methods do prove to be successful, the potential for successful field application of multi-step processes at the Gould site is far from assured.

the technology, cannot be finally determined without comprehensive testing of materials at representative site conditions.

5.6 MA INDUSTRIES, INC.

In July, 1987 a test was conducted on equipment manufactured by MA Industries, Inc. of Peachtree City, Georgia. The equipment chosen for the test is currently in operation at Ace Battery Company of Indianapolis, Indiana. Ace Battery uses the equipment to break and crush whole batteries, then to separate the battery materials into component parts of metallic lead, plastic, hard rubber (ebonite), and lead oxide.

The purpose of the test was to determine the effectiveness of the equipment in a proposed site application as part of Alternative 10. The application would consist of building a plant on the Gould site to separate the mixed primary source materials into components of metallic lead, plastic, ebonite, and lead oxide/dirt/mud. The primary process equipment would consist of the separation equipment sold by MA Industries.

5.6.1 Technical Approach

To conduct the test, approximately twenty tons of mixed materials were collected from different areas of the site and transported to Indianapolis for processing. The methods used to excavate, transport, and sample the materials are outlined in the engineering study work plan in Appendix B, along with information on the MA Industries process equipment. The results of the study consist of a series of sequential laboratory analyses also contained in Appendix B (see Laucks lab reports numbers 4793, 5499, and 5954). A summary of the results is presented in Section 5.6.2.

Five material streams emerge from the MA Industries separation equipment. The five streams are (1) metallic lead; (2) hard rubber (ebonite); (3) plastic; (4) lead oxide/mud; and (5) lead oxide/mud. Note that two of the streams contain lead oxide/mud mixtures; this is a function of the arrangement of the classifiers in the process arrangement, which can vary depending on the size of the equipment.

The goal of the analytical testing of materials emergent from the equipment was to determine the lead content of the various separated streams, which is a critically important consideration for recycle of the materials. The lead content is especially important for the plastic and the ebonite, which must be low in lead for successful recycle. In order to determine the nature of the lead remaining in the plastic and ebonite after separation, a series of sequential laboratory analyses was performed. The series consisted of total lead and TCLP lead analyses on the plastic and ebonite as received from the separation equipment, then after two different kinds of washes: (1) a wash with deionized water; and (2) a wash with hydrochloric acid followed by a "quench" wash with deionized water.

5.6.2 Results and Discussion

The total lead and total solids content of the metallic lead, plastic, ebonite, and lead oxide/mud streams is summarized in Table 5.6-1. Also shown is the TCLP result for plastic and ebonite before any washes. Two samples were run for each; the first sample represented material primarily from the Gould property, while the second sample represented material primarily from the Rhone-Poulenc property. In the table, the lab results for the two lead oxide/mud streams are averaged for presentation. For additional detail, refer to Appendix B.

TABLE 5.6-1

SOURCE MATERIALS AFTER SEPARATION

Material	Total Lead (% dry wt.)	TCLP Lead (mg/l)	Total Solids (%)
Gould Property Sample:			
Metallic Lead	93.7	--	100.0
Plastic	0.28	76	98.1
Ebonite	0.74	200	93.9
Lead Oxide	15.8	--	70.4
Rhone-Poulenc Property Sample:			
Metallic Lead	50.1	--	100.0
Plastic	0.39	140	90.0
Ebonite	1.4	210	93.2
Lead Oxide	28.8	--	69.2

The analytical results on the separated streams show that plastic and ebonite both fail the TCLP lead test, and the degree of failure is not particularly dependent upon the location of the material; plastic and ebonite from the Gould property fail nearly as badly as plastic and ebonite from the Rhone-Poulenc property.

Also of interest is the percentage of lead in the metallic lead stream, which is one measure of efficiency of separation. In the metallic lead stream received from the separated material on the Gould property, about 94 percent of the stream was lead; the remainder was non-lead metal and other debris. But in the metallic lead stream received from the separated material on the Rhone-Poulenc property, only about 50 percent of the material was lead. Since the percentage of metallic lead is much lower on the Rhone-Poulenc property (less than 0.1 percent) than on the Gould property (about 1-1.5 percent), the efficiency of separation clearly is shown to decrease as the percentage of lead in the source material decreases.

As discussed in the technical approach, plastic and ebonite were subjected to two washes after separation. The effect of the washes is summarized in Table 5.6-2.

TABLE 5.6-2

RESULTS OF PLASTIC AND EBONITE TREATMENTS

Material	Treatment	Total Lead (mg/kg)	TCLP Lead (mg/l)	Total Solids (%)
Plastic(1)	No Wash	3350	108	94.0
Plastic	DI Wash(2)	3350	112	89.8
Plastic	Acid Wash/ DI Wash	2260	72	94.2
Ebonite(1)	No Wash	10700	205	93.5
Ebonite	DI Wash	5050	205	86.4
Ebonite	Acid Wash/ DI Wash	16050(3)	195	92.0

(1) Total lead, TCLP lead, and Total solids are averages of sample results from Gould property and Rhone-Poulenc property.
(2) DI Wash = Deionized water wash.
(3) Average of 2 values: 3100 mg/kg and 29,000 mg/kg.

The results in Table 5.6-2 show that a deionized water wash has no observable effect on the total lead content of either the plastic or the ebonite. This result indicates that the lead is not surficial on either the plastic or the ebonite; rather it would appear to be interstitial and/or bound into the solid matrix of the material. The results following a short wash with hydrochloric acid show that the lead was not significantly removed from the ebonite, and only a minor fraction was removed from the plastic. The results indicated that much more vigorous treatment of both separated materials is required before recycle can be seriously considered.

In a normal operating mode, the MA Industries equipment processes whole battery casings, not the mixture of materials represented by the Gould site source materials. Certain problems were observed with the equipment that would need to be compensated for in design of a field-scale unit. Two problems are noteworthy here:

1. A key consideration is that materials must be able to be crushed in the hammermill if they are to be successfully processed. For the Gould site, the practical consideration is that extensive and continuous labor would be required to hand-pick all rock, rock-like matte pieces, and other debris (wood, concrete chunks, auto body metal, etc.) from the feed stream to the separation equipment.

2. A second consideration is that extremely heavy foaming, which greatly complicated the separation process, was noted during the processing of materials that contained significant fractions of dirt. Since this is the condition for nearly all of the primary source material, the problem would need to be rectified in the design phase.

As a final note, another user of the MA Industries equipment has reported high water usage of the system, which would complicate the already-high expected maintenance requirements.

5.7 POLY-CYCLE INDUSTRIES, INC.

Following the completion of the MA Industries test, a second separation test was performed on equipment manufactured by Poly-Cycle Industries, Inc. of Jacksonville, Texas. The equipment used for the test is currently in operation at Poly-Cycle's Jacksonville plant. The purpose of the test was much the same as the test performed in Indianapolis. In addition to examining the performance of Poly-Cycle's separation equipment, however, Poly-Cycle expressed interest in determining the marketability of the separated components. Poly-Cycle has had some success in finding applications for recycled ebonite, primarily as an additive to drilling muds used in the oil exploration industry.

5.7.1 Technical Approach

To conduct the test, approximately 20 tons of mixed materials were again collected from different areas of the site and transported to Jacksonville, Texas for processing. The methods used to excavate, transport, process, and sample the materials are outlined in the engineering study work plan in Appendix B. The results of the study consist again of a series of laboratory analyses also contained in Appendix B. A summary of the results is presented below.

Poly-Cycle's equipment has the same purpose as MA Industries', but the operation is somewhat different. Whereas five material streams emerge from the MA Industries separation equipment, only three emerge from Poly-Cycle's equipment: (1) plastic; (2) lead oxide/mud; and (3) metallic lead/ebonite combined. After the combined metallic lead/ebonite stream emerges from the separation equipment, Poly-Cycle air-dries the metallic lead/ebonite, then passes it through an additional piece of equipment (called a "Green Machine") for separation of metallic lead from ebonite. After such separation, the ebonite is ground to a particle size suitable for subsequent use, primarily in the oil exploration industry.

As with the MA Industries equipment, the goal of the analytical testing of materials emergent from Poly-Cycle's equipment was to determine the lead content of the various separated streams. Because of the time frame of testing relative to submittal of this Feasibility Study, the only testing accomplished to date has been analysis of the lead oxide/mud for total lead, analysis of the plastic for total lead and TCLP lead, analysis of the separated metallic lead and ebonite streams for dry weight percent lead, and analysis of the ebonite ground to various particle sizes for total lead and TCLP lead.

5.7.2 Results and Discussion

The results of the analyses are shown in Table 5.7-1. Additional details are presented in Appendix B. The results show that the plastic and ebonite again fail the TCLP test. The results on plastic are somewhat more promising than those from the Ace Battery test; TCLP lead in the plastic is 13 mg/l with no additional washing. However, the results for ebonite are even worse than those from Ace Battery. A key piece of information is the result for metallic lead in the separated, unground ebonite: the analytical laboratory reported 0.4 percent, or 4000 mg/kg, metallic lead in the ebonite prior to grinding. This result would indicate that the degree of separation of metallic lead from ebonite was wholly inadequate, because no matter what the subsequent treatment of the ebonite, the lowest total lead result, without another physical separation step, would be 4,000 mg/kg.

TABLE 5.7-1

TEST RESULTS FROM POLY-CYCLE INDUSTRIES EQUIPMENT

Material	Total Lead	TCLP Lead (mg/l)	Total Solids (%)
Plastic	310 mg/kg	13	94.1
Lead Oxide	52.0%	--	80.1
Metallic Lead	99.5%	--	----
Ebonite (unground)	0.4%	--	----
Ebonite (coarse)	1,100 mg/kg	200	96.2
Ebonite (medium)	40,000 mg/kg	99	97.8
Ebonite (fine)	5,900 mg/kg	170	96.9

5.7.3 Second Poly-Cycle Test

Following the completion of the Poly-Cycle test, representatives of Poly-Cycle determined that the high lead content in the ebonite could be due, in part, to improper settings and/or operation of the "Green Machine" used for separation of metallic lead from ebonite. To determine the possible impact of this variable on the overall process, a second test of the Poly-Cycle equipment was performed.

The test procedure for the second test was intended to duplicate the first procedure. Excavation and loading of material at the Gould site took place on November 20 and 23, 1987. Processing of the material at Poly-Cycle began on November 30, 1987. After an initial run through the equipment, a visual examination of the ebonite showed the presence of bits of metallic lead and debris that would likely preclude successful recycle of the ebonite.

The ebonite was then passed back through the separation process. Visual examination still showed signs of lead in the ebonite, so the ebonite was passed through the "Green Machine" step of the process twice more. Results on ebonite (and other materials) from the various steps along the process are contained in Table 5.7-2. The results for ebonite show a relatively weak correlation between the number of times the ebonite was processed and the total and TCLP lead concentrations. However, in only one sample (ebonite coarse-ground with one pass through the process) was the total lead content below 1000 mg/l, and the TCLP lead concentration was always well in excess of 5 mg/l; the lowest TCLP lead concentration for the ebonite was 41 mg/l, for ebonite that was passed through the "Green Machine" four times.

As a result of the two tests at Poly-Cycle, the conclusion is drawn that not only is the equipment in need of additional process design to allow adequate physical separation of the primary source materials, but an as-yet undefined additional processing step is required to effect a total lead content that will allow recycle of the ebonite.

5.7.4 Ebonite Recycle

Poly-Cycle's primary interest in the Gould site materials is in recycling the ebonite, lead, lead oxide, and plastic. Since most of the material is ebonite, that has been the focus of the recycling effort. Ebonite is currently marketed by Poly-Cycle as a drilling mud additive for the oil exploration industry. In discussions with NL-Baroid, it has been learned that a limit of 1000 mg/kg on the total lead content of the ebonite exists prior to considering the ebonite for use as an additive.

In addition to the Baroid limit, NL Industries and Gould Inc., from corporate points of view, will not accept the liability that attends recycle of materials with high lead content. None of the samples of ebonite met both a total lead limit of 1,000 mg/kg and an EP Toxicity limit of 5 mg/l. The lowest total lead found was 950 mg/kg; that value represents the only total lead value less than 1,000 mg/kg from all of the tests run at Ace Battery and at Poly-Cycle. The lowest TCLP lead concentration received throughout all of the trials was 41 mg/l, from the ebonite sample passed four times through the Poly-Cycle process during the second test. The present conclusion is that ebonite, given the current state of process development, is not a recyclable component at the Gould site.

TABLE 5.7-2

SECOND TEST AT POLY-CYCLE INDUSTRIES

Material	Times Processed*	Total Lead	TCLP Lead (mg/l)	Total Solids (%)
Plastic	--	6200 mg/kg	88	95.0
Lead Oxide	--	4.0%	--	88.9
Metallic Lead	--	90.7%	--	--
Ebonite (unground)	1	5300 mg/kg	420	97.0
Ebonite (medium)	1	6500 mg/kg	200	93.8
Ebonite (coarse)	1	950 mg/kg	55	95.2
Ebonite (unground)	2	3700 mg/kg	110	95.6
Ebonite (medium)	2	4900 mg/kg	85	95.5
Ebonite (coarse)	2	1200 mg/kg	77	95.3
Ebonite (unground)	4	1800 mg/kg	41	97.0

*Number of times sample was passed through the separation process.

5.8 UNITED SCRAP LEAD

During the conduct of the FS, contacts were made with other industry sources to determine the state of efforts made to address site conditions that are similar to those at the Gould site. The effort made at the United Scrap Lead site is noteworthy.

United Scrap Lead is a Superfund site near the City of Troy, Ohio. From 1946 to 1980 the operators of the facility processed discarded batteries to reclaim the lead components for resale. Throughout the operational history, United Scrap Lead used the various waste components from the normal operations as fill material on the site. Those wastes included rubber and plastic battery casings, metallic lead, and spent acid. In September 1984, the site was placed on the NPL under CERCLA.

During conduct of the RI, it was determined that approximately 55,000 cubic yards of waste battery casings and associated materials are present at the site. There is extensive soil contamination as well. The primary health threat is direct contact with the lead-contamianted materials.

A treatability study was conducted (see Appendix B) to determine the amenability of the primary source materials to reduction in lead content for subsequent recycle. Of direct relevance to the Gould site is the method used during the treatability study to reduce the lead content of the rubber casings. The investigators used samples of mixed casings containing approximately 70 percent rubber, 15 percent lead oxide/mud, 3 percent metallic lead, and 12 percent moisture. The samples were then tumbled in a ball mill with various wash solutions to determine the ability of the solutions to reduce the lead content of the rubber casing material. The results of the washes, reported in Table 5 of the treatability study in Appendix B, are reproduced in Table 5.8-1.

TABLE 5.8-1

RESULTS OF UNITED SCRAP LEAD BALL MILL WASHING

Wash Solution	Post-Wash Rubber Casing Lead Content, ppm	Remarks
Ammonium acetate (4%) + acetic acid (3.5%)	2,520	Readily filtrable
Tetra-Na EDTA (5%) or Di-Na EDTA (5%)	1,563	Extremely difficult to filter
Tap Water	2,500	Readily filtrable

Following the ball mill washing, the rubber casings were subjected to a sonic cleaning and soaking. The results of this treatment, reported in Table 6 of the treatability study in Appendix B, are reproduced in Table 5.8-2.

TABLE 5.8-2

RESULTS OF SONIC CLEANING AND SOAKING OF BATTERY CASINGS

Method	Lead Remaining (mg/kg)	EP Toxicity Lead (mg/l)
1-15 min. sonic cleaning	540	44
3-30 min. sonic cleaning	370	--
6 day soak	76	15.5
3 day soak in 5% EDTA + 15 min. sonic cleaning	30	5

The investigators conclude that the various wash, soak, and clean steps show promise for treatment of the casing material. The investigators also conclude that much more work needs to be done to determine the relevance of bench-scale lab results to a field-scale process unit. In particular, the long retention times noted in the wash steps would pose two very significant problems: 1) size, location, and operation of tankage needed to achieve these retention times; and 2) handling of the leachate water after the leach/wash step is complete.

Perhaps the most important conclusion to draw from this study, as well as all of the studies performed at the Gould site, is that although there appears to be promise for any of several treatment applications, the state of the technology is developmental and much work needs to be done to transfer the technology to a feasible approach to remediation of sites and recycle of contaminated primary source materials.

5.9 GRANITE CITY

A CERCLA site at Granite City, Illinois has inorganic metals contamination problems, with lead-contaminated source materials, including ebonite, remaining on site. Data available from the site show the results of lead in ebonite following an engineering test to separate source materials. At the Granite City site, separation equipment manufactured by Cal West was used for the study.

A somewhat sketchy report on the separation tests shows that following component separation, three analyses were performed to determine the total lead content of the ebonite at the site (see Appendix B). The three data points for the ebonite reportedly show a total lead content ranging from 105,000 mg/kg to 286,000 mg/kg. The average of the data is 193,000 mg/kg total lead in the ebonite.

Without more information about the parameters of the test, it is difficult to draw strong conclusions. However, the data represents results achieved on a third type of manufactured equipment for source material separation, and the reported results are certainly not encouraging.

5.10 SUMMARY

Perhaps the strongest conclusion to draw from all of the studies reported in this section is that the state of technology for treatment applications at the Gould site and similar sites is developmental. Particular problems demonstrate the fact that the separation equipment is generally designed to handle whole batteries, rather than the mix of materials that remain at the Gould site. Technology for field-scale removal of lead from ebonite is only at the research stage at this point.

Much work remains to be completed to allow transfer of the separation technology studied during the FS to a feasible approach for remediation of sites and recycle of contaminated source materials. The equipment and methods to accomplish the task are simply not available today.

6.2 EVALUATION OF RECYCLE POTENTIAL

An evaluation of the potential for reducing toxicity, mobility, and volume at the Gould site must include a consideration of the amount of material that is potentially recyclable. A discussion of the potential for recycle at the site follows.

The average weight percentages of the various components in the primary source material is calculated in Table 1.3-6 and summarized below in Table 6.2-1. This information, combined with information from contacts made during the conduct of the FS permits an estimate to be made of the quantities of primary source materials that are potentially recyclable.

TABLE 6.2-1

PERCENTAGE BREAKDOWN OF GOULD SITE SOURCE MATERIALS

Material	Percentage of Total (by wet weight)
Ebonite	74.3
Plastic	3.0
Metallic Lead	0.6
Lead Oxide/Dirt/Mud	10.2
Rock/Slag	3.2
Other	1.5
Moisture	7.2
TOTAL	100.0

By far the largest component of the material is ebonite, which represents some 74.3 percent of the site material. Various potential markets for ebonite were assessed during the FS. Because of its high lead content, among other reasons, its potential for use as a fuel in a cement kiln is at present doubtful. ASARCO offered an assessment of the use of ebonite as a fuel for the smelter operated by ASARCO in East Helena, Montana. The ebonite contains certain organic binders, which were added to the rubber to confer cohesiveness to the battery casing. These binders, in ASARCO's experience, can cause serious problems with carbon black emissions which carry over into ASARCO's acid plant, thus rendering the acid unsalable. Without further assessment, ASARCO is uninterested. The other potential major use of ebonite, discussed in the Section 5.0 evaluation of the Poly-Cycle tests, is as a drilling mud additive. A primary user of the additive is NL Industries' Baroid Division, which determined the Gould site ebonite to be entirely unmarketable because of the high lead content.

Plastic represents about 3.0 percent of the primary source material on the Gould site. An indefinite amount of the plastic is expected to be potentially recyclable to plastics processors such as battery manufacturers, who can tolerate unusually high lead levels, but not to processors of other consumer plastic goods where human contact is more direct. An assumption on recyclability is that eventually a market may exist for about half the plastic. Because the plastic fails EP Toxicity for lead, the remaining half would need to be disposed of as a hazardous waste.

Metallic lead, which constitutes about 0.6 percent of the primary source material, is probably 100 percent recyclable through a lead smelter. The lead oxide/dirt/mud fraction constitutes about 10.2 percent of the source material. Through laboratory analysis of the lead oxide/dirt/mud stream from separation tests reported in Section 5.0 of the FS, the lead content of this fraction is seen to be highly variable, ranging from about 5 percent lead to about 52 percent lead. On average, the lead content of the stream has been 22.3 percent, which means the lead oxide content of the stream (as PbO) is about 24 percent. The remainder of this stream then, 76 percent, represents dirt and mud which is not separable from the lead oxide in separation equipment tested to date.

Contacts made during the FS reported that a lead content of such a lead oxide stream should be about 40 percent before profitable smelting for lead recovery can occur. It is possible that a smelter may accept payment for the lead shortfall, however its inferior grade is likely to be seen more as a nuisance to the smelter than a resource. An inferior grade of lead is more troublesome to process and can lead to inferior grade products. As such, it will not likely be processed quickly when received by a smelter; it will instead be saved for times when no other feedstock is available, or ultimately be disposed of in a Class I RCRA landfill by the smelter or its customers as required by RCRA regulations. So its ~~ultimate~~ recycle even if sent to a smelter, is not assured. An assumption is made that about 25 percent of all of the lead oxide/dirt/mud at the site is potentially recyclable. The remainder would need ~~to~~ be disposed of as a hazardous waste. For off-site disposal, the material would have to comply ~~with~~ 40 CFR 268 regulations governing solidification of liquids and lead content, which may be difficult to meet.

The previous discussion of recyclability is summarized in Table 6.2-2, which expands Table 6.2-1 to include a recyclability component.